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Green Structure Planning in Transit-Oriented Development (TOD)

A Spatial Analysis of Önnestad

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"...lengthy stays outdoors mean lively residential areas and city spaces" (Gehl, 2010, p. 79).

Sammandrag

Denna masteruppsats behandlar det amerikanska konceptet Transit-Oriented Development (TOD). Konceptet påminner om planeringsmetoder som har till stor utsträckning tillämpats i Sverige, sedan samhällsplaneringen tog fart på artonhundratalet. Källor talar om förtätningsfrågor som ett hot mot grönstrukturutveckling och bevarandestrategier. När det gäller hållbar planering, hävdas det att tyngdpunkten ofta läggs på ekonomiska besparingar, och övergången från bilberoendet till kollektivtrafiken och kompakta levnadsförhållande.

Dessutom beskriver studien begreppet grönstruktur och dess relation till TOD. Det existerar delade argument gällande grönstruktur, och dess status i stadsplaneringen. Dock talar mycket åt en framåtpekande process, där grönstruktur blir en viktig och integrerad del i stadsplaneringen, till exempel Green TOD initiativ. Studien visar att grönstruktur innehar åtskilliga värden som planeringsresurs. Dessa värden kan användas för att förbättra och hjälpa våra boendemiljöer, inte bara av praktiska skäl, men också i samband med hälsofördelar och sociala konsekvenser.

Studiens syfte var att undersöka sambandet mellan dessa två begrepp i en planeringssituation. En fallstudie gjordes i staden Önnestad, Kristianstad, Sverige. Önnestad har nyligen antagit en ny järnvägsstation. I anslutning till tågstationen, planeras det för framtida förtätningsåtgärder, tillsammans med blandade funktioner. Dessa planer adresserar grönstrukturutveckling. Kvalitativa intervjuer och observationsstudier genomfördes i Önnestad. Teori om sociala aspekter, med anknytning till utemiljön, studerades för att bättre förstå, och för att förstärka, de synpunkter som uppnås från allmänheten och observationerna. Det slutgiltiga syftet var att presentera några idéer kring förbättringar av grönstrukturen i Önnestad, baserade på de framtida planerna.

Analysen identifierade att möjligheten för en förbättrad grönstruktur i Önnestad är osäker. Slutresultatet av tågstationsmiljön uppvisar en gles mängd grönska, vilket förklaras inträffade på grund av otillräcklig finansiering. Studien pekar på att det redan i dagsläget finns en uppenbar brist på grönstruktur i norra Önnestad, där järnvägsstationen ligger, och den nya utvecklingen av orten föreslås. Vid utvecklingsområdet visas grönstruktur likt passager som endast omger komplexet. Fallstudien visar att på grund av bristen på grönområden i norr, kommer den föreslagna utvecklingen göra denna brist ännu tydligare, och därmed hävdar studien att i norr bör större grönområden med multifunktionella karaktärer uppmuntras, som balanserar användningen av ytterligare mark tillägnad bostäder för tillgänglighetsaspekter rörande hinder i landskapet, och att ta itu med bristen på grönstruktur, vilket skulle kunna bidra till att skapa tillgängliga och beboeliga miljöer för allmänheten i Önnestad.

Executive Summary

This thesis addresses the American concept Transit-Oriented Development (TOD). The concept resembles planning methods which have been widely applied in Sweden, since community planning took off in the nineteenth century. Sources speak of densification matters being a threat to green structure development and conservation strategies. Regarding sustainable planning, it is argued that the emphasis is often put on economic savings and the shift from car dependency towards public transport and compact living.

Moreover, the study sees to describe the concept green structure, and its relation to TOD. Split arguments can be found regarding the status of green structure in urban planning. However, much speaks of a forward thinking progress, where green structure becomes an important and integral part in urban planning, such as Green TOD initiatives. The study shows that green structure has many values as a planning resource. These values could be used to enhance and assist our living environments, not only for practical reasons, but also in connection to health benefits and social implications.

The study's aim was to investigate the link between these two concepts in a planning situation. A case study was made in the town of Önnestad, Kristianstad, Sweden. Önnestad has recently adopted a new train station. In connection to the train station location, there is future densification measures planned together with mixed functions. These plans address green structure development. Qualitative interviews and observational studies were conducted in Önnestad. Theory of social aspects related to the outdoor environment were studied to better understand, and to give some additional meaning, to the views attained from the public and the observations. The end effort was to present a few ideas relating to green structure improvements in Önnestad based on the future plans.

The analysis identified that the possibility for green structure improvement in Önnestad is uncertain. The end result of the train station environment displays a sparse amount of greenery, which is explained, occurred due to insufficient funding. The study points to that there is already an apparent lack of green structure in the north of Önnestad, where the train station is located, and the new developments are proposed. The development area displays green structure through passages located merely surrounding the complex. The case study suggests that due to the shortage of green areas in the north, the proposed developments will make this deficiency even more apparent, therefore the study argues that in the north, larger green areas of multi-functional characters should be encouraged, to balance the use of additional land devoted to housing, for accessibility issues related to the barriers in the landscape, and to address the deficiency of green structure, which could assist in creating accessible and livable environments for the public in Önnestad.

Acknowledgments

I would like to thank the people in Önnestad for their willingness to participate in my study. Special thanks to Mattias Qviström, from who I received excellent guidance and tutorship from, and by whom I was inspired to study and research about TOD. I would like to thank my partner Fredrik Savin for providing me with the pictures of Reston, and for his support in taking notes during the interview phase of this thesis.

Camilla Nilsson, Malmö, Sweden, 2014

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1. INTRODUCTION

1.1 Background

This thesis builds upon the municipality of Kristianstad's future visions for the urban area of Önnestad, in particular its green structure development. The thesis also addresses the concept Transit-Oriented Development (TOD).

In Swedish, the TOD concept could be translated into 'kollektivtrafikanpassad samhällsplanering och bebyggelse' (Stojanovski, 2013). It was formed by the American architect and urban city planner Peter Calthorpe in the 1990's. TOD could be defined as a guiding principle, aimed to integrate cities and public transport systems. It is about creating sustainable and compact cities that encourages 'walkability' and 'placemaking' on an urban scale. It also sees to form places for networking at a regional scale. It is targeted towards increasing network capital, and the suitability for human living in communities and regions (Stojanovski, 2013).

An important focus in the guidelines of TOD is to encourage transit integration. TODs are used to decrease urban sprawl and assist in planning urban areas in a more efficient way (Calthorpe, 1993). 'Green TOD' is seen as a growing concept in Europe. It derived from a linkage between TOD and Green Urbanism. Rather than being presented individually, it is believed that a mix of these two concepts can form synergies and therefore bring more environmental benefits (Cervero and Sullivan, 2010).

Önnestad gained a new train station on the expanding commuter train line Pågatågen in December 2013. This was done following an initiative by the Swedish Transport Administration, with the aim of developing the train traffic in the south of Sweden. Önnestad are among sixteen urban areas with new and previously active train stations, which are now trafficked by Pågatåg and Krösatåg (trafikverket.se). It could be fair to argue that Önnestad already has qualities that are associated with TODs. In Önnestad, distances are short with a maximum of one kilometre to access public uses (kristianstad.se). In the municipality's Comprehensive Development Plan (CDP), March 2013, Önnestad is presented as a 'basort' or 'main urban area'. The future vision is that these areas are to function as service nodes for the surrounding rural landscape (kristianstad.se, 2013). In the CDP, it is stated that Önnestad is one of the urban areas within the municipality of Kristianstad, which is expected to grow the most in coming years. Due to the re-introduced train station, it will become an attractive place for commuters travelling to Kristianstad and Hässleholm. In the municipality of Kristianstad's CDP, one is questioning how to best take advantage of the opportunities the train stations will bring for basorterna. In Önnestad the station location is pointed out as being the most interesting area to further exploit (kristianstad.se, 2013). In regards to green structure planning in Önnestad, there are municipal plans pointing out specific areas in connection to the station.

To address the green structure in Önnestad, the municipality of Kristianstad also suggests some improvements to the existing green structure. In relation to the future prospects, it makes the urban area of Önnestad an interesting target area for further study. From visiting and speaking with the people in Önnestad, observing and analysing the area, one finds that Önnestad lacks adequate green spaces, at least in the northern part where the train station is located and further developments are planned. This thesis takes aim at the place that is Önnestad, it gives an insight to the public view, the future of the place, it also sees to investigate what green structure could entail as part of a TOD.

1.2 Purpose

While working with a densification project in Skåne as part of an internship at an engineering company in Malmö, I became interested in the integration of green structure in relation to building processes. I realised that the integration of green structure is often regarded as a secondary attribute in planning processes.

Trafikverket and Region Skåne recently invested in new train stations in the northeast of Skåne, which gave me the opportunity to investigate one of the urban areas selected. It gave me opportunity to analyse methods of working with green structure in relation to the newly established train station area.

The thesis provided me with gaining more in-depth knowledge of the TOD concept as a model for urban development. It also gave me the opportunity to further educate myself in the field of landscape architecture. I hope that the issues which have been touched upon in this thesis will be of interest to both students and professionals, within the fields of architecture and planning.

The objectives with this thesis were to firstly explore the TOD concept as explained by its founder and other relevant key literature addressing the concept. Secondly, to investigate municipal future plans related to green structure development in Önnestad, and thirdly the objective was to gain the perceived views of the outdoor environment in Önnestad, through qualitative interviews with the public in Önnestad, together with observational field studies. The approach proceeded in linking these findings in a landscape analysis with the assistance of relevant theory regarding social aspects related to the outdoor environment. The fourth and final objective was to analyse the conclusions drawn from the study and land on relevant conceptual ideas of how to move forward with the planning of green structure in Önnestad, in relation to TOD and the proposed densification measures at the station location.

1.3 Research Questions

The following two research questions have been formalised and were identified during the first stage of the underlying research conducted at the very beginning of this thesis process, and are in line with theory regarding the aim and the purpose of this study.

(1) In what way is green structure spoken of in the TOD literature?

(2) What could Önnestad's green structure entail as part of a Transit-Oriented Development (TOD) in relation to social aspects?

1.4 Delimitations of the Study

Due to the nature of this study, which involves interviews at site, together with observational studies and site analysis, the focus of this thesis is limited to the case study of Önnestad. Further constraints are that the scope lies on the spatial green structure experiences of Önnestad, together with theories of social aspects. The study is limited to American and Swedish examples of the TOD concept. The work is constrained to a conceptual analysis, and therefore no detailed drawings of the guidelines resulted from the spatial analysis are addressed in this thesis.

1.5 Method

The thesis investigates the TOD concept in relation to green structure development, with the urban area of Önnestad as a case study. In order to obtain the relevant knowledge and information required, theory on the subject has been reviewed and analysed in combination with primary research conducted on site in Önnestad. This includes document analysis of municipal guidelines and future plans, field studies, and a spatial analysis.

To be able to as accurately as possible capture the interviewee's perceived living environment and related activities, feelings and emotions, a qualitative research interview technique has been adopted. The interviews have been used to gain an increased understanding of the urban area, and to capture aspects that the author as an outsider would not otherwise have thought of. These findings were then incorporated into the spatial analysis.

The method of working with the interviews and the observational studies in Önnestad are influenced by Lynch's (1960) interviews and observational studies in 'The image of the city'. It is also influenced by the observational studies carried out by Jan Gehl (2010) in 'Life between buildings'. Findings are analysed and discussed in relation to theories of social aspects, as approached in the writings of Lynch (1960 & 1972), and Gehl (2010), with a focus on the green structure of Önnestad.

The social aspects studied in relation to the primary research conducted in Önnestad build upon broad interpretations of social aspects tied to identification, orientability, recreation, and accessibility in the landscape. Lynch's (1972) later work 'What time is this place' has also been used in the analysis, which targets social values in relation to time and space.

In order to identify suitable approaches for working with Önnestad's green structure, both theory and findings made from the primary research have been taken into account.

1.6 Structure

The thesis is divided into four chapters. It sees to integrate theory and empirical data. Chapter one introduces the thesis and its intentions.

Chapter two treats TOD as a concept and its relation to green structure development, which concludes both Swedish and American interpretations. It also investigates publications with relevance to developments in connection to station locations. This chapter is primarily based on theory, it is finalised with a discussion addressing the ideas and concepts brought to light.

The third chapter, background to the case study, investigates the municipality of Kristianstad's plans for green structure development related to the densification measures at the train station area. The chapter highlights Önnestad's relationship to TOD as a urban planning ideal. It addresses the municipal planning documents, its Comprehensive Development Plan (CDP) (a strategic policy document which provides a vision for Önnestad's future), and a municipal planning programme established to provide a basis to the CDP.

The fourth chapter includes a spatial landscape analysis, combined with the qualitative interviews and observational studies, which were executed on site in Önnestad. It highlights the local population's view of the outdoor environment in Önnestad. It also discusses findings drawn from the interviews and observational studies, in connection to theory of social aspects, as presented by Gehl and Lynch. At the end of chapter four, the conceptual ideas are presented. The resulting suggestions are based on primary and secondary research. Reflections are made towards the validity of the data, and the usefulness of the results received from the method of working.

References are stated according to the Harvard Referencing System; in-text citations with a complete list of references at the end of the paper.

1.7 Literature Review

The TOD concept is addressed first and foremost as expressed in 'The Next American Metropolis' by Peter Calthorpe (1993), the founder of American TOD. It is complemented by newer interpretations by authors such as Robert Cervero and Cathleen Sullivan with their 'Toward Green TODs'. The publication 'Stationsnära läge' has been used to gain an idea of the regional and governmental view towards densification at station locations in Skåne, Sweden.

Further literature reviewed regarding TOD is Todor Stojanovski's thesis 'Bus rapid transit (BRT) and transit-oriented development (TOD)', and Katarina Schylberg's report 'Planindikatorer för effektiv markanvändning i stationsnära områden', which addresses accessibility, and orientation issues in connection to station locations.

In the effort of analysing the green structure concept, the author decided to make use of the explanation stated by the Swedish National Board of Housing, Building and Planning (Boverket), and Region Skåne, with the publications 'Bostadsnära natur', 'Grönstruktur i Skåne', 'Mångfunktionella ytor' and Grönstruktur i landets kommuner. Further definitions of the concept derive from a Governmental Proposition, and Kalle Magnér's thesis 'Det gröna och det allmänna'. The author's background as an architect has influenced the process in which literature on the subject green structure has been sourced. A student with more in-depth knowledge in the field of landscape architecture might have approached the literature on the matter in a different way or with another perspective.

The case study material is based on the municipality of Kristianstad's CDP (2013) (Översiktsplan) along with the planning program 'Nästa Önnestad!'. The historical view of the case study was sourced from the works of Nils Jönsson in 'Bland präster bönder och gärningsmän i en gammal göingesocken', and Malte Persson's work 'Önnestads socken en kulturgeografisk studie'. In analysing the findings drawn from the empirical data, theories of social aspects have been reviewed through the works of Kevin Lynch in 'The Image of the City', 'What Time is This Place', together with Jan Gehl's 'Life Between Buildings'.
The literature sourced for this thesis is comprehensive, yet it is a selection of material studied to target various views of green structure planning, in relation to the case study and the TOD concept.

1.8 The Case Study

The case study of Önnestad consists of secondary and primary research. The secondary research is related to municipal future plans for Önnestad, in relation to its newly reinstated train station. The primary study comprises of a spatial analysis of the green structure in Önnestad. It contains field studies consisting of qualitative interviews and observational field studies.

The interviews and observations took place when visiting Önnestad during the spring and summer of 2014. The interviews were conducted on five different occasions, including a pilot study. The first interviews were conducted in April, the second session took place in May, the third in June, the fourth and the fifth occurred in July. The interviews and the observations took place on different weekdays, holidays, various time intervals, and different times of the day. They were done in different weather conditions; additionally this work was performed throughout different seasons. One can claim that these factors made it possible to capture the usage of the outdoor environment at a broader scale in comparison to one single visit to an area of study. The method allowed me to recognise recurrent and timeless patterns of usage through observations, and assisted in sourcing a variety of subjects to engage in verbal conversations.

Fifteen people were interviewed based on a qualitative interview method consisting of a semi-structured technique influenced by Kvale (1997). The method assisted in capturing the interviewee's view of their living environment, the related activities, feelings and emotions attached to it, in a deeper and more detailed manner in comparison to a quantitative technique, where the focus is on hard data with absolute answers. This broader and exploratory research allowed for side-tracks, such as longer conversations with the same subject, making it easier for the interviewees to develop their answers and for the author to obtain their views.

The aim with the interviews was to capture the perceived spatial experiences of the outdoor environment in Önnestad, as described by the local population, people employed in the town, and people having another relation to the town. The reason for conducting observations alongside interviews, were to gain a more comprehensive and personal view of how the public use the outdoors. This was partly captured through traces or evidence of presence in space. With the aim of maintaining eye contact with the interviewee (whilst the interviewee provided their answers and shared their opinions), to assure them my interest in their opinions and answers expressed, an assistant were taking down notes whilst the interviewee spoke. This was done also to make sure valuable information was gained, regarding their point of view. The answers and opinions of the interviewees were noted as they were expressed by the individuals.

1.8.1 Reflection Surrounding the Selection Process

The selection was based on voluntariness to participate in interviews. However, the goal was to be able to relate to an individual's relation to the area, in order to draw some generalisations around the findings made.

It could be said that many of the individuals who were willing to be interviewed were ideal for the purpose of the study, as many of them were long-time residents of the urban area and/or well acquainted to the area (e.g. frequently spends time outdoors), an advantage which meant that deeper information regarding the various outdoor areas of Önnestad and their qualities could be obtained. However, it could be questioned whether the ones who chose to participate in the interviews are representative for the group as a whole in relation to voluntary purposes, and the number of subjects interviewed in total.

1.8.2 The Interview Questions

In regards to the interview questions, the aim was to keep the structure of these as open as possible to assure objectivity, and to prevent the author of this thesis from steering the answers towards her own potential research goals. The interviewees were approached with a brief introduction of the subject. In order to describe what is meant by 'outdoor environment', a choice was made to make use of certain standard words. These keywords were: 'the landscape', 'park', 'seasonal activities', dog resting', 'sports', 'exercise activities', and 'leisure activities'.

The interviews were influenced by Lynch's (1960) technique, and based on the following questions:

(1) How do you make use of the outdoor environment?

(2) Can you show me the most important places in Önnestad? (interviewees were asked to show these places on a map)

(3) How do you reach these places?

(4) What do you do at these places?

(5) Does Önnestad's outdoor activities fulfill your needs of such, or do you need to travel somewhere else?

(6) (Supplementary question) What is missing or needs to be developed?

1.8.3 Strategy and Locations Used

Gehl (2010) states that walking is the main form for transporting oneself. Walking also gives one the opportunity to be in the public space freely and unofficially (Gehl, 2010, p. 133).

The observations were carried out while walking in the urban area, a method which also became a good way of sourcing interviews for the study, as individuals in Önnestad mostly walk to get to their desired location. Whilst walking around in Önnestad, the activities occurring in the public realm were carefully documented. The walking sessions took place all around the town, the neighbouring areas, the schools, the centre and at the train stop. These places were visited more than once. Some observations were made while sitting down at places for a longer period of time, looking at the behavior of people passing by, reflecting on what they were doing, how they went about, if they were walking or cycling, in what direction they were heading towards, and the regular routes taken at any given time.

Frequently used locations for carrying out the interviews became the local grocery shop 'Matöppet' and Focks väg (the road next to the strain station), where most activities in the urban area could be spotted. Other locations where interviews took place were at the grounds of the community college, 'Nisses', a grill next to the highway, and at Skolgatan.

The majority of the interviews were conducted in Swedish. However, since this thesis is written in English, the questions are hence translated.

2. TRANSIT-ORIENTED DEVELOPMENT (TOD)

The planning concept Transit-Oriented Development (TOD) was founded in the United States in the early 1990's by an architect and planner named Peter Calthorpe. In 'The next American Metropolis, Ecology, Community and the American dream', Calthorpe (1993) defines TOD in the following manner:

"The Transit-Oriented Development (TOD) concept is simple: Moderate and high-density housing, along with complementary public uses, jobs, retail and services, are concentrated in mixed-use developments at strategic points along the regional transit system" (Calthorpe, 1993, p. 41).

Stojanovski and Kottenhoff (2013) provide the closest definition of the TOD concept in the Swedish language: 'kollektivtrafikanpassad samhällsplanering och bebyggelse' (Stojanovski and Kottenhoff, 2013, p. 11). The publication 'Samordnad kollektivtrafik- och bebyggelseplanering' by Sveriges Kommuner och Landsting (SKL) dated December 2013, states that the concept has been visible for many years in Swedish physical planning. The publication further explains that many parallels can be drawn between the contemporary debates within (1) sustainable mobility research, (2) TOD-related writings, and (3) that which characterised the early 1900's urban and transport planning, between WWI and WW2, and the immediate post-war years. During this period, the hub of urban transport systems consisted of various forms of rail-bound public transport and cycling. SKL (2013) further claims that what is practiced in urban planning today is a re-occurrence of previously tested techniques, which have been additionally developed based on the knowledge of present society. This knowledge is often related to sustainable development and energy enhancement objectives (SKL, 2013, p. 6).

Carlton (2007) explains that the most authoritative precedent to TOD is Ebenezer Howard's garden city movement from the late nineteenth century United Kingdom. The garden city entailed multiple garden cities that were surrounded by greenbelts and the countryside. The requirements compromised limits of dwelling densities and close connections to central areas; a metropolis was created by inter-municipal rail (Carlton, 2007, p. 6).

Stojanovski (2013) explains that TOD is, in its American context, referred to as being an integrated part of the New Urbanism movement. In European terms the concept of the compact city can be viewed as a direct parallel to the American TOD, due to the principals they have in common. He argues that TOD takes aim on the vast spread city centres, the suburbs which occurred due to urban sprawl and edge cities that are suffering from bad connectivity due to insufficient public transport (Stojanovski, 2013, p. 16). Along these lines he states that:

'TOD is not a matter of replicating historical cityscapes, but a way to understand the structuring effect of public transportation infrastructures in urban areas and regions' (Stojanovski, 2013, p. 24).

Stojanvovski (2013) defines TOD as a product and a process which inhabits various scales, involving a range of different stakeholders. He highlights that the common vision of the product are walking environments of high quality, compact and mixed-use developments in or at close connection to transit stations. He continues with explaining that American TOD can be viewed as a policy that aims to synchronise cities and public transport systems. Moreover, he states that the concept sees to increase the suitability for human living in regions and communities. The idea behind TOD, according to Stojanovski (2013), is the willingness to establish sustainable cities that are compact and which see to encourage urban 'walkability' and 'placemaking' possibilities in urban environments (Stojanovski, 2013).

Carlton (2007) claims that the TOD concept was invented by Calthorpe (1993) with the view of it being an understandable strategy of dealing with regional growth, whilst at the same time decreasing the necessity for people to use their automobiles, by promoting living close to public transit services. He explains that Calthorpe's (1993) aim with TOD was that the concept could work as a tool to tend to community ecology (Carlton, 2007, p. 1).

Calthorpe (1993) himself describes TOD as a set of guidelines and definitions. He highlights that TOD compromises a mixed-use community feature. The average walking distance to reach the train station or the commercial centre within the community is 2,000 foot (approx. 600 metres) (Calthorpe, 1993, p. 56).

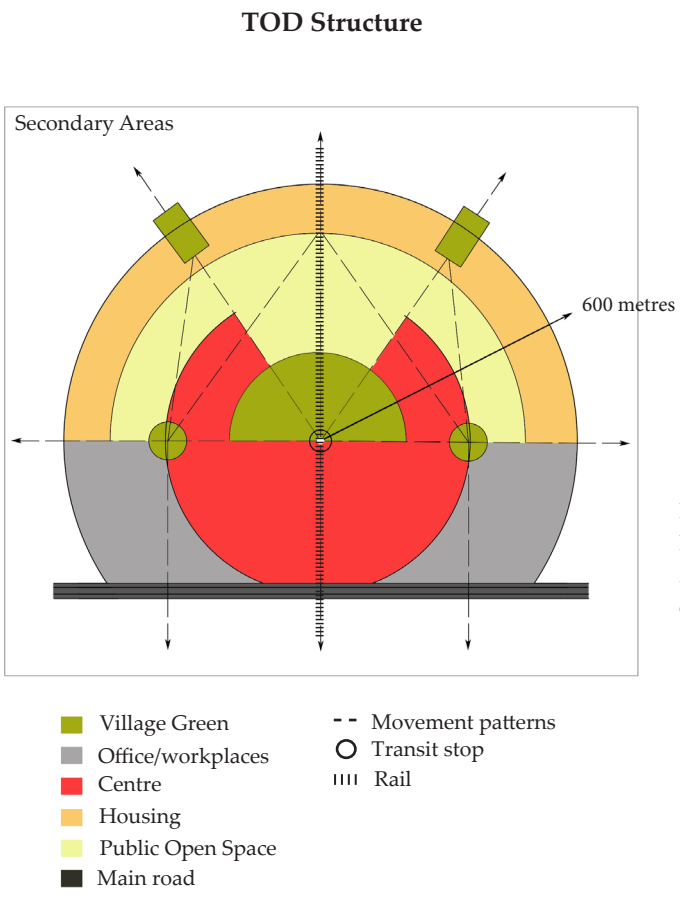


Figure 1: TOD structure showing the locations of different public uses (modified from Calthorpe, 1993, p. 45 (Transit-Oriented Development (TOD))).

He states that TODs compromise a mix of workplaces, open areas, shops along with residential living, in an environment designed for walking. He further pinpoints that within a TOD, one should effortlessly be able to travel by public transport, walk or bicycle within the community (Calthorpe, 1993).

2.1 TOD as Planning Tool

The TDM Encyclopedia, which is founded and updated by the Victoria Transport Policy Institute, states that ways of implementing TOD can include establishing new public transport lines and new stops and stations, designing new suburban communities surrounding public transport hubs, or small adjustments to already established urban communities, where public transport is available (vtpi.org, 2014).

Calthorpe (1993) states that the TOD design guidelines involve development in both metropolitan regions and in urban areas. He explains that Infill Sites, Redevelopable Sites, and New Growth Areas, are all possible environments for TOD implementation. Key requirements for TOD plans are the ability to act in accordance with the already established adjoining neighbourhoods relations, personality and fragile environmental conditions (Calthorpe 1993, p. 50).

Calthorpe (1993) points out that the assistance of capital used towards redevelopment projects and transit as a catalyst, may have transitional effects on older neighbourhoods and inner city areas. Transitions could lead to new and more intense uses. He suggests guidance for these types of amendments towards strengthening the transit system, through producing configurations and land uses that are less expensive, connected to the metropolitan area and that are pedestrian friendly. He discusses that sites of redevelopment and infill places can be situated in newly established suburban areas or in urban areas that has existed for a longer time. He states that the street grid, which is often present in older city locations, makes it easy to establish linear connections across local applications. New suburban areas often suffer from a disconnected street pattern; therefore one must find ways of establishing walkable links from infill developments to local sites (Calthorpe, 1993, p. 50).

According to Calthorpe (1993), TODs uses and setups ought to be based on the neighbouring areas. Another requirement is that they lay on, or in connection to, the main line of a communications, transportation system or wider local and/or regional bus networks. He explains that depending on where a TOD is located, its uses and character differ due to parameters such as regional position, the market supply and/or demand chain and what the land is used for. He also highlights that service supply and transit frequency should be measured to fit the density and context of the area (Calthorpe, 1993). Calthorpe (1993) further discusses that there are two variations of the TOD concept, 'Urban TOD' and 'Neighbourhood TOD'. He states that Urban TOD features a position directly attached to transit networks, to reassure a direct connection to public transit. The aim is to achieve a space consisting of compact residential areas of medium to high levels, high commercial levels and to create job opportunities (Calthorpe, 1993).

He explains Neighbourhood TODs as being positioned within a distance of ten minutes by bus from a main transit line, and distance between stops should be no longer than 3 miles (5 kilometres). He points out that recreational, residential, service, retail and civic levels at these locations should be aimed to target moderate usage. Moreover, he continues with stating that Neighbourhood TODs provide accessibility for children and the elderly, and encourages people to walk and bike. Well-designed Neighbourhood TODs Calthorpe (1993) highlights could form neighbourhoods that hold adequate public parks and facilities, fits the context and values and the quality of the existing neighbourhood and diminishes car traffic (Calthorpe, 1993, p. 56-57).

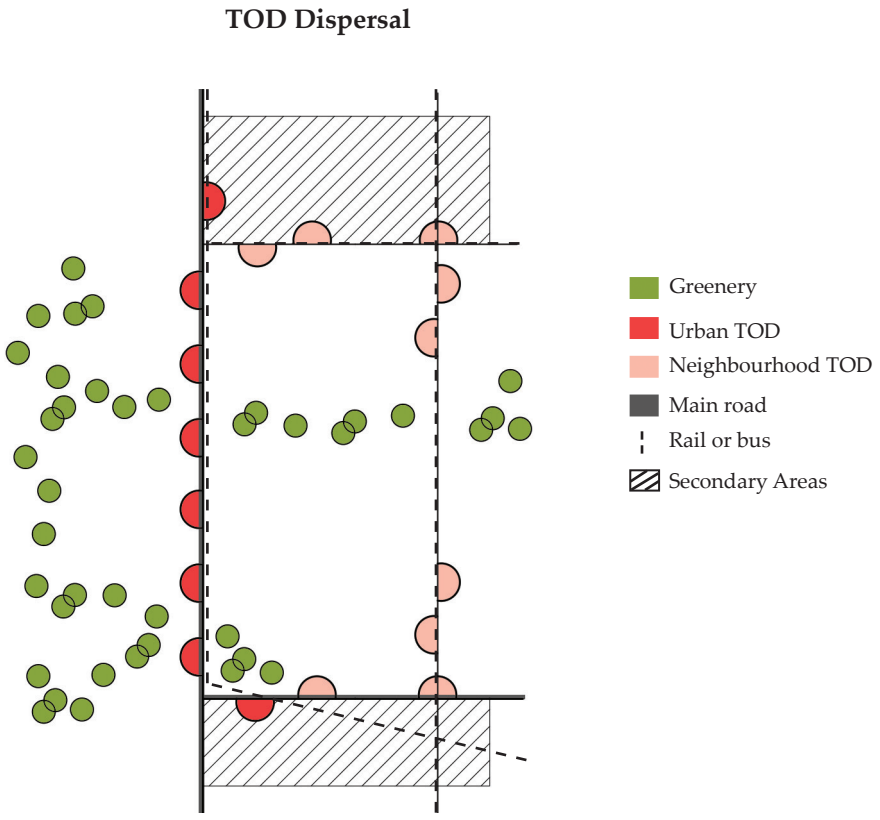


Figure 2: TOD dispersal in relation to traffic networks (modified from Calthorpe, 1993, p. 67 (Distribution of TODs)).

Lehmann (2010) explains that due to the aging population trend, requests for housing close to TODs will grow in numbers. The household types that are predicted to opt for TOD living, according to Lehmann (2010) are the households that in the following two and a half decades are expected to increase the most. These are: (1) singles, (2) the elderly, (3) couples without children, and (4) low-income minority households. He includes that the common denominator is that all of these segments rely on cost efficient public transit systems (Lehmann 2010, p. 227).

The report Stationsnära läge (2010) one may argue, discusses TOD in relation to train stations in Skåne. The term 'Stationsnära läge' addresses developments in connection to train stations (Länsstyrelsen i Skåne et al. 2010, p. 9). Moreover, the agency report highlights that in Skåne, 80 percent of the land within one kilometre of station locations are unoccupied land (Länsstyrelsen i Skåne et al. 2010). The agency report contains a mapping study, which sees to show the preconditions for Skåne's train stations and their locations. The study involved identifying factors that contribute to transit usage, such as accessibility, and other factors that could define needs of development. In the comparison between the stations, which were chosen for the study, the aim was to possible travelling patterns that derive from the structure of the station area (Länsstyrelsen i Skåne et al. 2010, p. 16, 22).

The agency report further describes that an area surrounding 600 to 1000 metres distance from the station is a 'stationsnära läge'/development in connection to stations, a guideline which is partly inspired by Hartoft-Nielsen's (2002) report 'Stationsnærhedspolitikken i hovedstadsområdet – baggrund og effekter'. This report contains briefings on several research projects about urban development and the relation between urban development and transport. Hartoft-Nielsen's (2002) report includes a number of case studies, which highlights the issues regarding implementation, the realisation of planning and location policies (Hartoft-Nielsen, 2002).

According to the agency report, the defined distance of 1000 metres surrounding the train station location is based on Hartoft-Nielsen's (2002) report, and the agency's intentions of including a greater area around the station location. The agency report concludes that to be able to form deeper analyses of the areas selected for the study, a delimitation of 1000 metres is an appropriate distance (Länsstyrelsen i Skåne et al. 2010, p. 10).

Katarina Schylberg's (2008) thesis concerns the development of a planning aid which builds on planning indicators, and associated tools and methods. She argues that this could be implemented in planning situations adjacent existing station locations involving, for example, land-use change and the localisation of interchanges. Her other objective with the thesis was to study the planning aid in relation to a local implementation, to analyse potential issues and advantages related to the method (Schylberg, 2008, p. 4).

She points to accessibility and orientability issues in relation to station locations, stating that in connection to distances from target points, 600 and 1000 metres are important thresholds. Furthermore, she refers to efficient land use in the sense of having activities concentrated in a walkable distance to the station, and by integrating the areas adjacent the station and the station area with the surrounding neighbourhoods, and thereby increasing the stations accessibility in the local area. She stresses that in relation to densification in areas with good public transport, there are no defined guidelines in Sweden on how this should be carried out (Schylberg, 2008).

She adds that there is no requirement for municipalities to recognise the consequences of the traffic systems relating to additional scattered developments, as claimed by the former government agency, Vägverket (2007).

Schylberg (2008) refers to TOD both as a strategy aimed to stimulate high levels of public transportation, and one which is steered towards establishing attractive urban environments. She concludes that TOD has had the greatest impact in countries suffering from spread out settlement structures, such as Australia and America (Schylberg, 2008, p. 39).

She continues with highlighting that if the station and its immediate surroundings are to be an integrated part of an attractive urban environment, one must pay attention to the pedestrian movements and the station location in relation to the largest and busiest routes. She highlights that potentially the preconditions for people choosing to spend time at the station could increase, together with those who happen to pass by the station, due to the context of other engagements, other than that of travelling (Schylberg, 2008, p. 48).

In her thesis Schylberg (2008) states that intensive land-use consisting of workplaces, residential buildings and target points, which are frequently visited, and located at a walkable distance from the station area, provides good preconditions for public transport. She explains that this in turn triggers other public uses that establishes movement patterns and which as a result increases security, and creates an attractive urban environment. Moreover, she discusses that there are disadvantages with a too far driven densification method, which can in a densification process result in a scanty and unsatisfactory environment, where the occurrence of green passages and public spaces are inadequate (Schylberg, 2008, p 56).

2.2 The Green Structure Concept and its Relation to Urban Development

In the report Bostadsnära natur (2007), the government authority Boverket, explains the meaning behind the concept green structure. The authority explains that a structure can be formed from green areas, which is independent of ownership and management, and if this structure is portrayed in the right manner, the divided urban landscape can be interlinked. More specifically, this process is achieved through connecting green passages, parks, and water areas, and thereby grouping the elements into one single context. This context assists in strengthening the identity of an area, and making the urban environment more orientable (Boverket, 2007, p. 19).

The authority notes that in Sweden, the concept originated in the development of community planning. More specifically, the concept was introduced in the late 1960s, when it became more common to perceive the greenery in urban areas as a continuous form (Boverket, 2012). In order to understand the concept green structure and its progression in Sweden, the authority points to the multi-functionality of the urban green, which has since the 1940's been a focus point (Boverket, 2012, p. 7).

Attributes such as climate adaptation, dispersal corridors for flora an fauna, health issues, purer air together with aesthetic values, are explained by Boverket (2012) as being qualities that features an abundant green structure (Boverket, 2012, p. 7).

Magnér (2013) explains that social, cultural, structural or ecological features are among many aspects that the green structure concept could be defined by. Moreover, he notes that by addressing to its spatial boundaries is the standard approach of interpreting the concept in Sweden (Magnér, 2013, p. 20).

In the Government Proposition 1994/95:230, it is noted that green structure is a collected concept covering, for example, all soft surfaces not settled in the environment, the immediate and the surrounding landscape, the green corridors leading from the built areas onto the landscape and the bordering zones in-between urban areas (riksdagen.se, 1995). The proposition highlights the importance of the connections formed by the edges of the urban areas, explaining that these fringes or edges provide areas for day water and waste water management, pathways for flora and fauna dissemination along with supplying us with recreational activity grounds. The proposition further stresses that vital to human development and health related issues, is the possibility of being able to access a varied and abundant natural environment (riksdagen.se, 1995).

The report Stationsnära läge (2010) defines green structure values as being the opportunities supplied for recreational purposes, biodiversity, improved air quality, health benefits related to the presence of greenery, climate adaptation measures which can be achieved with greenery, and aquatic environments (Länsstyrelsen i Skåne et al. 2010, p. 57). Green values are described by Magnér (2013) as the values and functions that are significant when defining green structure (Magnér, 2013, p. 20).

Sandelin (2012) refers to Boverket (2002) and proclaims the importance of green structure as an urban element. He states that its properties includes: (1) giving character and identity to the city, (2) simplifies navigation and (3) acting as a channel between land and city. Additionally, he explains that green structure helps with dividing a city into different parts or alternatively be a dividing element (e.g. tree avenues or other green areas) (Sandelin, 2012, p. 27).

2.3 Green Structure and TOD

In relation to ecology and habitat, Calthorpe (1993) notes:

"Natural features provide visual relief and establish a unique character for a community, whenever possible open space resources should be incorporated into the design of TODs and Secondary Areas" (Calthorpe, 1993, p. 72).

He continues with suggesting that in order to sustain natural habitats, careful planning should be promoted. In turn, this initiative could result in a community with integrated natural features. Instead of being handled as edges to areas of exploitation, the natural features should hold a status as central conveniences (Calthorpe, 1993).

In regards to purpose, natural features could work twofold, by both providing public entry access and protecting resources (Calthorpe, 1993, p. 72). The founder of TOD suggests that natural features should be integrated within the community. He suggests that these features, which can be relevant for both resource protection and public access. Moreover, he states that while sensitive habitats and natural features are preserved, public accessibility should be given. He further explains that in TODs, the bicycle paths can host twofold functions. If developed for instance alongside connecting creeks, the paths can make urban open space available to the public, and establish connections to other destinations, for example parks. He points out that links should be created between these paths and the greater public establishments, such as places for recreation, schools and parks (Calthorpe, 1993, p. 72).

The TDM Encyclopedia (2014) notes TOD best practice to be about integrating public transit and physical planning, decreasing vehicle parking surfaces at stations. Moreover, the independent research organisation states that it is also about establishing a community of mixed-use, which is densely planned, along with achieving pedestrian-oriented environments. In regards to zoning at a proactive level and the regulation for land use, the organisation states that the aim is sophisticated growth levels, and environments of high quality, which are achieved through acting in anticipation of future issues (vtpi.org, 2014).

It is stated in Stationsnära läge (2010) that in regards to all densification approaches which occurs on green spaces, the existing green structure and the values it carries, must be taken into account. Moreover, the agency report adds that one should take into consideration the range of positive effects derived from green structure and measure these against densification benefits. The agency report further states, that in some cases densification could result in financial possibilities that could lead to further development of existing green areas, and/or rehabilitation measures (Länsstyrelsen i Skåne et al. 2010, p. 57).

2.4 Green TOD

In the chapter 'Ecology and Habitat', Calthorpe (1993) declares the importance of biological systems, wastewater reclamation, natural drainage systems, character of trees and energy conservation systems TODs could imply. This direction could be about introducing applications such as on-site biological water harvesting systems, to use for arable land nearby, or on-site watering. In relation to landscaping, he explains that plant species used should be either tested or approved with the local climate or be of a domestic kind (Calthorpe, 1993). Regarding energy conservation strategies, he suggests methods involving maximising daylight inlet, microclimate, establish shading by trees, natural ventilation and solar energy (Calthorpe, 1993, p. 74-75).

Cervero and Sullivan (2010) highlights the concept 'Green TOD' and explain that it derived from a linkage between TOD and Green Urbanism, and that it is a growing concept in Europe. Rather than being presented individually, the authors point out that a mix of these two concepts together can form synergies and therefore bring more environmental benefits. The synergies could result in, for example, higher densities that in turn triggers an increased use of public transit, higher diversity of land use, more open space, gardens, less parking surfaces, conservation of cooling and heat expenses, and solar production connected to stations and stops (Cervero and Sullivan, 2010).

According to the authors, the TOD policy works to reduce environmental footprints of cities. Green Urbanism strategy consists of forming green architecture and other sustainable neighbourhood creations and to tackle waste and emission outlets. In the approach of working with green urbanism, the surface parking, for example, could be transformed into community gardens and pocket parks (Cervero and Sullivan, 2010, p. 4-5).

Cervero and Sullivan (2010) pinpoint that Green TODs can assist in diminishing developments' carbon footprint by 35 percent. In regards to city regeneration projects, Green TOD experiences are analysed in countries such as Sweden and Germany. The authors further explain that there are few TODs in the US that deliberately have been designed as Green TODs. Efficient public transport, renewable sources and recycling, are more conventionally promoted in sustainable neighbourhoods (Cervero and Sullivan, 2010, p. 3, 8).

The authors note, that the urban development project 'Hammarby Sjöstad' in Stockholm, which took off in 1995- (predicted to be finished in 2015), is a good example of a Green TOD implementation (Cervero and Sullivan, 2010, p. 9). Hammarby is a previous brownfield site, which was redeveloped due to Stockholm's Comprehensive Development Plan dated 1999, which focused on conserving and developing Stockholm's identity and its green structure, together with the strategy of 'building the city inwards' (bygga staden inåt) (stockholm.se, 2002). The whole area is connected through a boulevard, which holds both traffic and services. Inside the area there are parks, promenade paths of different characters, and water which holds a central focus in the establishment (stockholm.se, 2011). Stockholm stad explains that Hammarby Sjöstad has received their own environmental programme, in order to decrease environmental impacts (stockholm.se, 2011, p. 5).

The Cumberland Community Improvement District (CID) is a tax district formed voluntarily by the local commercial property owners. It recognises and progresses public infrastructure, a process which is done foremost in regards to transportation and capital improvements (Cumberland CID, 2010, p. 7). The district is an edge city positioned in northwest Atlanta, Cobb county, Georgia, US. It supports public and private infrastructure collaboration projects. In the tax districts report entitled 'A Framework For Green Transit-Oriented Development' (2010), a sustainable redevelopment of its town's commercial centre is visualised, entailing a walkable, lively and mixed-use community. In order to achieve this, the Cumberland CID aims to introduce light rail (the project is currently on hold) (Cumberland CID, 2010).

The tax district refers to the framework as a model, which could be used within the Atlanta region for re-development purposes of its suburban communities and nationwide, and one which could assist in creating more livable communities. The tax district states that the Green-TOD framework provides one with a map regarding the requirements needed to achieve a region that is accessible, vibrant and sustainable. The framework embodies TOD studies, best sustainable practice, suburban redevelopment, and LEED for Neighborhood Development (LEED ND). The latter is a system which recognises if a proposed or existing development can be considered environmentally superior, alongside site preconditions and health impact assessment. A total of six constituent parts were recognised as the basis of the framework, which were:

(1) Smart Location and Linkage (SLL), (2) Neighborhood Design and Walkability, (3) Green Infrastructure and Buildings, (4) Innovation and Health, (5) Community Process and Place Making, and (6) Policy and Implementation (Cumberland CID, 2010). The tax district further notes that when the Green-TOD framework is implemented, it will make a marked change to the regions society, its environment and its economy (Cumberland CID, 2010, p. 7).

In terms of sustainable and green development, the Cumberland report (2010) reveals that the Green-TOD model recommendations are:

(1) Establishment of a Town Green, including green areas in connection to stations, accommodate a variety of activities, for example an urban plaza, open air theatre, open field of a multi-use character, that is TOD oriented, (2) Complete Streets will be adopted, that promote walking and cycling, is accessible for everyone and still provides access for cars, (3) A watershed plan is to be developed to assure the conservation of water, stormwater management, strategies for collection of rainwater and gray-water reuse etc., and (4) redevelopment and LEED-ND guidance for sustainability purposes (Cumberland CID, p. 11).

The Green-TOD model includes available open spaces together with parks that also integrate stormwater handling. The green features of the town incorporate the existing open areas, and connect to trails surrounding the community (fig. 3) (Cumberland CID, 2010).

Regarding social benefits, the tax district states that the walkable and livable communities resulting from a Green TOD approach will have a positive effect on resident health. The tax district notes that by supplying options for transit and green space access, the residents that engage in physical activities will increase, in turn improving the health of the residents in that specific area, and the enhanced management of stormwater will improve water quality of nearby creeks and rivers. The tax district additionally explains that densely planned neighbourhoods will contribute to more close-nit and social communities (Cumberland CID, 2010, p. 7).

The CID Green-TOD Model

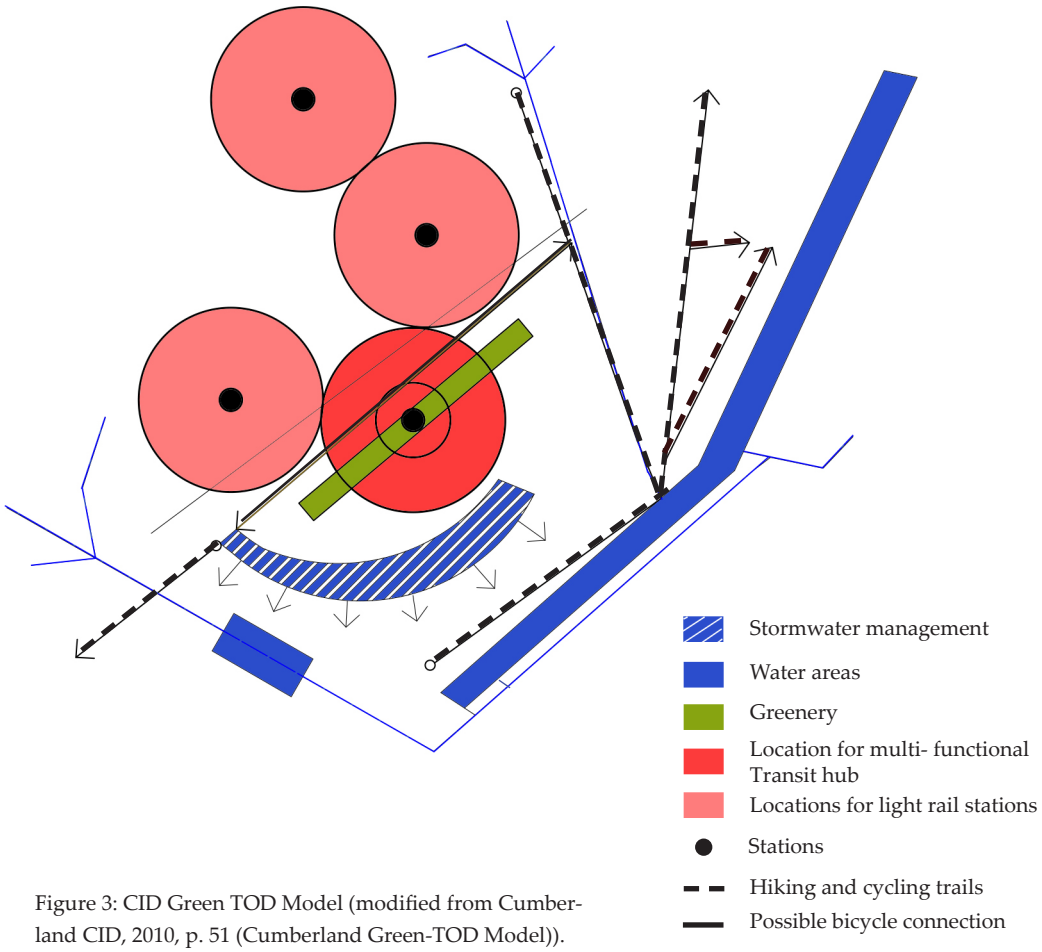


Figure 3: CID Green TOD Model (modified from Cumberland CID, 2010, p. 51 (Cumberland Green-TOD Model)).

The report 'Conceptual Green Infrastructure Design for the Blake Street Transit-Oriented Development Site, City of Denver' by The United States Environmental Protection Agency (EPA) (2013), is an example of conceptual design strategies involving stormwater run-off. The Blake TOD site is located in the state of Colorado in Denver's Five Points neighbourhood. In close connection to the neighbourhood lies the first station of the scheduled East Corridor Commuter Rail Line, and a distance away is the South Platte River. According to the agency, the Blake TOD site comprises six buildings which were obtained in 2011 by the Urban Land Conservancy (ULC) (EPA, 2013, p. 1).

The agency states that the aim with obtaining the Blake street site was so that the ULC could be able to supply the public with inexpensive housing in close proximity to a main transit line (EPA, 2013). In order to attain several of both environmental and livability objectives through applying green infrastructure in the early stages of the development, the ULC looked for technical support from the EPA (EPA, 2013, p. 39).

The report suggests that by realising concepts of green infrastructure at the Blake TOD site, it could result in releases of better water quality to the South Platte River (EPA, 2013). The agency further notes that green resources are expected to supply improved livability to the space diminish urban heat island effect, by providing shade made up of trees and vegetation, green roofs, and cooling methods for pavements and roofs (EPA, 2013, p. 3).

A conceptual stormwater management design was specified by an EPA team. The design revolved around efforts of complementing and strengthening the proposed TOD site, through:

(1) Bioretention strategies, both at the private locations and at the public legally granted accessways, (2) permeable pavements, applied between buildings and incorporated into the sidewalks, and (3) green roofs for stormwater catchment purposes, in residential reachable areas (EPA, 2013, p. 39).

The EPA (2013) states that green infrastructure was applied everywhere before adding any grey infrastructure, which was a requirement in order to reach the criteria of the design (EPA, 2013, p. 17). The report adds that due to the approach used at the Blake TOD site, which involved introducing green infrastructure methods in the early stages of a project, helped to integrate green infrastructure into the revival of an urban infill area (EPA, 2013). Implementing green infrastructure concepts at the Blake TOD site will, according to the EPA (2013), help improve water quality discharging to the South Platte River, and assist in increasing the livability of the area by incorporating green features (EPA, 2013, p. 3).

The agency continues with stating that, along with the quality of meeting stormwater management objectives, the conceptual design proposed for the planned Blake street TOD site, displays the effect that green infrastructure can have, in terms of establishing a more attractive and livable environment, that incorporates natural features inside the built environment (EPA, 2013, p. 39). Furthermore, the EPA (2013) explains that studies have shown that people living in greener neighbourhoods tend to walk more due to that the distances seem shorter. The agency concludes with suggesting that by applying methods of green infrastructure, which increases the neighbourhood vegetation, could assist in founding environments that are pedestrian friendly, and which promotes outdoor activities (EPA, 2013, p. 4).

Reston is a community situated in Fairfax County, Virginia, US. It adopted plans in February 2014 for creating TOD districts in relation to three new stations on the Washington Metrorail's new Silver Line. The development around these station areas are planned to take place during the next 40 years. In conjunction with approving the TOD development, the county published a Comprehensive Plan, which in detail provides guidance on the redevelopment of the area around these station areas for the next 25-30 years. The idea behind the initiative is to meet future expected housing and employment growth, whilst at the same time taking the best possible advantage of the new metro line (County of Fairfax, 2014, p. 23).

The county's aim with the TOD districts from a planning perspective is firstly to establish a neighbourhood focused on transit within approx. 800 metres of each station which is designed to encourage pedestrian activity at all times of the day. Secondly, the county aims to create areas and connections for pedestrians and cyclists alike, which are both attractive and safe for these two groups (County of Fairfax, VA, 2014, p. 4). Moreover, the county has made it clear in their policy plan that the development around the stations and related neighbourhoods should be steered by green principles. An interesting factor regarding Reston's adoption of TOD, is that the final recommendations for its new plan was based on input from over 40 members, all over the community, from businesses and property owners to local residents, a process which first started in 2009 (County of Fairfax, 2014).

Reston has since it was founded developed into one of the US's landmark new cities (County of Fairfax, 2014, p. 7). In the community's guiding principles, it is stated that the town's original goals, which have shaped its planning for the last 40 years, included that anyone, independent of income and life stage, should be able to live within their neighbourhood throughout their entire life. It should also be possible to both live and work in the community and engage in recreational activities (County of Fairfax, 2010).

The county's initial master plan from 1962 addressed mixed-use development, which makes it highly relevant to TOD (County of Fairfax, 2014, p. 7). Another interesting point is that the county recognises that it is important that the community's planning and design principles are not fixed and instead developed based on external forces in the world we live in (County of Fairfax, 2010, p. 1).

Figure 4: Reston's green town square (Photo by Savin, 2014).

Figure 5: Gravel shortcut in Reston beside the roadway, where trees have been planted (Photo by Savin, 2014).

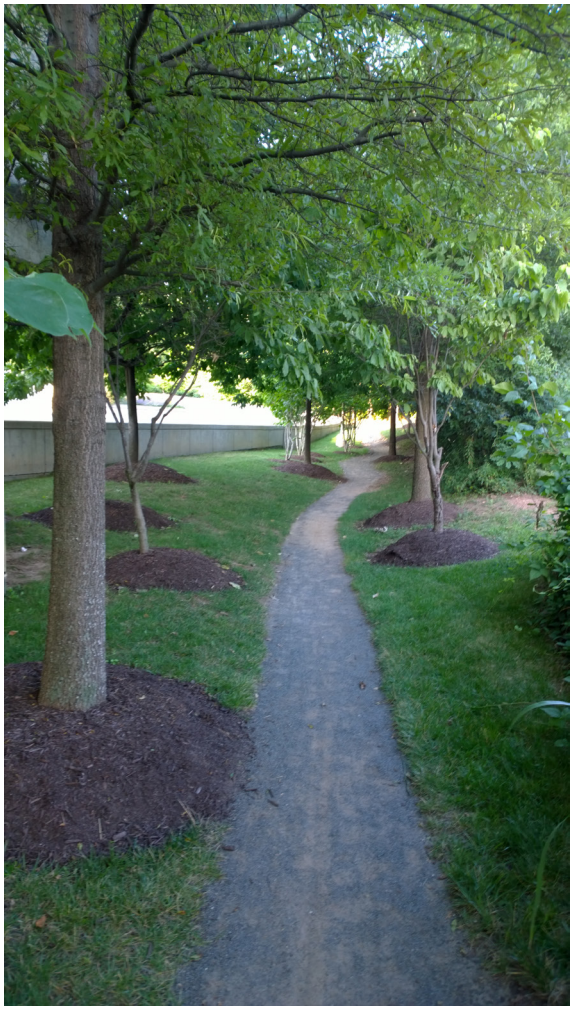


Figure 6: Pedestrian path in Reston, the grass is growing right onto the edge of the concrete slabs (Photo by Savin, 2014).

Figure 7: Solar panel in Reston (Photo by Savin, 2014).

2.5 Green Structure an Attractive and Important Spatial Element in TOD

Boverket (2007) states that by connecting green areas and water areas, and referring to them as one single form, as mentioned previously, results in a city where the identification process is made easier, along with the ability to orientate oneself (Boverket, 2007). The authority states that the foundations of a city are represented by its infrastructure, settlement structure and its green structure. Boverket (2007) highlights that in relation to transportation, such as cycling and walking, and meetings amongst people, green areas can host as stimulating environments where these activities can take place (Boverket, 2007).

The authority continues with explaining that green areas are part of the public space, and they are often the city's democratic places. Furthermore, the authority pinpoints that green structure, which attracts many people to engage in recreational activities, regardless of age, ethnicity and income, is the kind not influenced by commerce and industry. Green structure can be crucial in the aim to engage people in urban planning, because it is part of our immediate environment (Boverket, 2007, p. 19-20).

In the report Stationsnära läge (2010) it is stated that an attractive city means that the environments are well illustrated, through: (1) good public meeting spaces, (2) available green areas, (3) that the development takes the place's cultural heritage into account, and that (4) the development fits in with the character of the place (Länsstyrelsen i Skåne et al. 2010, p. 50).

In the same context, Calthorpe (1993) speaks of parks and plazas being public focus points in neighbourhoods, and defines these places as the basic attributes of pleasant and livable communities, and as tools for strengthening residential and retail areas, by accommodating places for events and gatherings of the public kind (Calthorpe, 1993, p. 90). He points to Village Greens as an approach to reintroducing the 'commons' into the core commercial areas, where people meet, converse, lunch etc. Arguing that these areas once helped establish community identity, by bringing people together from different neighbourhoods, commerce and service facilities (Calthorpe, 1993, p. 92).

Brännlund (2013) explores modern tramways and its potential for sustainable development. He investigates the interaction between tramways and green structure. He states that the process of preserving and expanding parks and green areas in Europe is today an ongoing trend. The motives following the approach are:

(1) Improved recreational opportunities, (2) allotments, and (3) urban farming; an approach which is threatened and often counteracted by the need of densifying cities (Brännlund, 2013, p. 25). In relation to green structure values, he states:

...'green structure values and functions must be recognised in order to motivate planners in investing in green structure' (Brännlund, 2013, p. 51).

He further notes that in order to attain solutions and goals of the collaborative kind that can bring significant opportunities in the aim of achieving a sustainable city, it is important to find a holistic approach towards green structure and transport structure (Brännlund, 2013, p. 51).

In relation to the discussions surrounding climate change, Brännlund (2013) suggests that green structure could assist in counteracting and mitigating extreme weather conditions and the damages occurring due to its forces (Brännlund, 2013, p. 25). In regards to climate adaptation, the publication Stationsnära läge (2010) opts for the importance of green and blue environments, such as trees, and day water handling systems, to combat the effects of climate change issues. The report refers to its assistance in diminishing flood risks, daylight inlet, shade and wind speed (Länsstyrelsen i Skåne et al. 2010, p. 50).

2.6 Achieving a 'Livable Community' According to TOD

Calthorpe (1993) explains that a TOD is built in accordance with accessibility and convenience. He states that it is about to be able to supply a safe and comfortable neighbourhood environment, strong community bonds, identity, ability to take part in the community and friendliness are important building blocks. The vibrancy in TOD is an important factor that is achieved through the public applications role of providing areas of recreation and meeting grounds. In order to serve the community needs, all TODs are required to supply its public with available open space areas. Parks that carry frequent visitors are placed in the centre of the community and has good visibility (Calthorpe, 1993, p. 59).

The TDM Encyclopedia (2014) states in regards to 'Livable Communities' that TOD as a planning concept could assist in creating neighbourhoods that are both more social and physically attractive places to reside in. The online information source explains that the term 'Livability' is very much influenced by what is happening in the public space, the places where people meet, converse and spend their free time in, it is also affected by public order and planning applications within the community. In regards to 'Community Livability', the TDM declares this to be defined in the way in which an area's environmental and social qualities are perceived by its residents, workers, and its visitors. It is also about factors such as health and safety, the state of the local environment, air, water quality and noise. It refers to the ability of social interaction within the community, fairness, respect and identity. It concerns the accessibility to engage in recreational activities, the presence of cultural and historical remains (vtpi.org, 2014).

2.7 Achieving a 'Livable Community' According to Theories of Social Aspects

The Danish architect and urban consultant Jan Gehl (2010) explains that lively neighbourhoods are the result of people choosing to spend more time outdoors. He continues with arguing that a key effort to increase the amount of time people choose to spend outdoors would be to improve the residential area's preconditions for outdoor activities (Gehl, 2010, p. 79).

In the case that people are attracted to linger in a specific space for a longer period of time, the amount of people and activity level may intensify (Gehl, 2010). His ideas around this can be illustrated by the following quote:

"...lengthy stays outdoors mean lively residential areas and city spaces" (Gehl, 2010, p. 79).

He considers the ground surfaces to be of importance in terms of accessibility, specifically for individuals, who are less able to adjust to inadequate conditions (Gehl, 2010, p. 135). Furthermore, he suggests that the possibility of moving around effortlessly and safe, the ability to stay for longer periods of time in a city location or in a residential neighbourhood, and being able to enjoy the pulse of the city, its architecture, and its spaces, meeting a range of people unexpectedly or at date set, are key to successful cities and neighbourhoods of both present and past. He further frames these factors as humble requirements in the approach of achieving an enhanced supporting structure for everyday activities (Gehl, 2010, p. 51).

In relation to happenings in the public space, zones for staying are vital. Gehl (2010) studies edge zones, which are the places where one can remain in the public eye, whilst maintaining individual territory. They are transitional zones, where one space changes into another, he explains. These places could be found in the interconnection between two spaces, and in relation to the facade of buildings. According to Gehl (2010), edge zones exist where the view of surveying a place is the best possible (Gehl, 2010, p. 149). His theory regarding the importance of visual connections in neighbourhoods are important features which makes up for safer environments (Gehl, 2010, p. 61) One may argue that social continuity is an important aspect part of establishing the structure and sustainability of a society.

2.8 Discussion

It could be said that the TOD concept is an urban planning ideal in its formation. It is not absolute truth, and it is one which can vary in relation to site specific preconditions and contexts. One could even claim that TOD is an ideal vision of a prefabricated sustainable development product of the 20th century, for example the ideal of the compact city, the garden city by Ebenezer Howard, or other forms of sustainable planning methods. These are approaches which seek to find ideals of how we should live our lives, either it is about economic savings, densification measures to ease sprawl, or other heroic measures to try and salvage the environment and/or live in harmony with it.

With the aim of seeking an answer to the thesis research question: 'In what way is green structure spoken of in the TOD literature?', the procedure has been to reflect on how green structure is represented in the TOD literature.

One can claim that green structure in relation to TOD is not discussed in the TDM Encyclopedia, other than being a complimentary attribute, neither is the concept Green TOD discussed. Stojanovski (2013) does not mention the concept green structure; neither does he discuss it in relation to TOD. He speaks of greenery in relation to the green city, as being a counterpart to the compact city. In terms of sustainability, it could be said that much emphasis is put on the economic savings, and densification to combat further urban sprawl. The Green TOD initiatives, supplied by the Blake street project, the Cumberland project and Reston, are some proofs that the willingness of working with green structure and/or greenery as an integral part of TODs exists, whether it is regarding infrastructural solutions or other green approaches.

The problem in the transition of applying green infrastructure early in project phases could relate to insufficient understandings of green structure benefits to densified living. There also seems to be a lack of economic founding for green structure development in connection to TODs, and the traditions of urban planning methods is another barrier. Regarding green structure and attractiveness of urban environments, the report Stationsnära läge (2010) point to that an attractive city means that the environments are well illustrated. In relation to the aforementioned, the immediate thoughts that come to mind are; what do these urban environments look like? Where should they be located in relation to developments in connection to stations? The report reveals no specific design guidelines of how the environments could look like and/or where they could, or should be placed in the previously explained scenario, other than that it would be achieved through having satisfactory public meeting places, green areas available, minding the cultural heritage of the place and making sure the development fits in with the context of the space.

One could claim that green structure guidance in relation to developments in connection to station locations is in the aforementioned report addressed through a very general view, in terms of dealing with green structure attributes in densification processes.

Schylberg (2008) stresses that there are disadvantages with a too far driven densification method, which according to her, can leave one with an unsatisfactory environment, where the presence of green passages and the occurrence of public spaces are insufficient (Schylberg, 2008). In relation to that Schylberg's background is the field of landscape architecture; it is surprising that she speaks very little regarding greenery being an important and incorporated element in planning for accessibility, and placemaking. Brännlund (2013) sheds some light into the arguable fact that the green structure values and its functions ought to be considered in the aim of motivating planners to invest in green structure (Brännlund, 2013). This is in my opinion a very important statement; green structure planning should be recognised in the very beginning of the project phase.

When studying green structure in relation to TOD, one may argue that green structure is spoken of very sparsely in the reviewed theory. Calthorpe (1993) speaks of Town Green, and natural features being integrated key amenities, although it can be found that greenery is presented much as isolated green areas, and is fairly structured in its form, at least inside of the core of the TOD complex.

Regarding green structure connections, the case differ Calthorpe (1993) illustrates greenbelts situated surrounding TOD boundaries, where the whole of the rural areas are visualised as a green resource, for protection and in combination with public right of way. One may argue that natural features as central conveniences are lacking in the TOD literature. Did the idea wander of in the vision of an attractive urban environment?

One may question what it would mean, to adopt an American planning model used to combat urban sprawl into a Swedish urban planning situation? Do we have other preconditions which discourage this rather idealistic approach to planning? Do preconditions ultimately determine the success of TODs? Would factors such as weather conditions, the holding on to other similar planning precedents, for instance the compact city, and other societal needs, play a key role in the adaptation? One may argue that because the idea of TOD has roots in Swedish physical planning, and the large amount of vacant land at station locations in Skåne, are factors supporting future TOD adaptations in the region.

3. BACKGROUND TO THE CASE STUDY

Due to the lack of relevant research regarding green structure planning in the TOD literature, the study turns to the urban area Önnestad. The case study is approached with a spatial landscape analysis, which sees to determine what green structure entails in relation to Önnestad's spatial demarcations, and what its role as an urban element may hold as part of a TOD. Before focusing on analysing the green structure in Önnestad, with the assistant of empirical studies, the author argues that it would be appropriate to firstly provide an image of the case study, its preconditions related to green structure development, and its relationship to the TOD concept. The plans connected to future green structure development in Önnestad, are collected from and described according to the municipality's Comprehensive Development Plan (2013), along with planning strategies connected to the station location.

3.1 Önnestad

Önnestad lies approximately 10 kilometres northwest of Kristianstad. The town became its own municipal society in 1934 (Jönsson, 1952). In 1952, Önnestad and the surrounding areas Färlöv and Norra Strö, were brought together, and became Aralöv's municipality, which amounted in the municipality of Kristianstad in 1967 (Kristianstads kommun, 1982, p. 4).

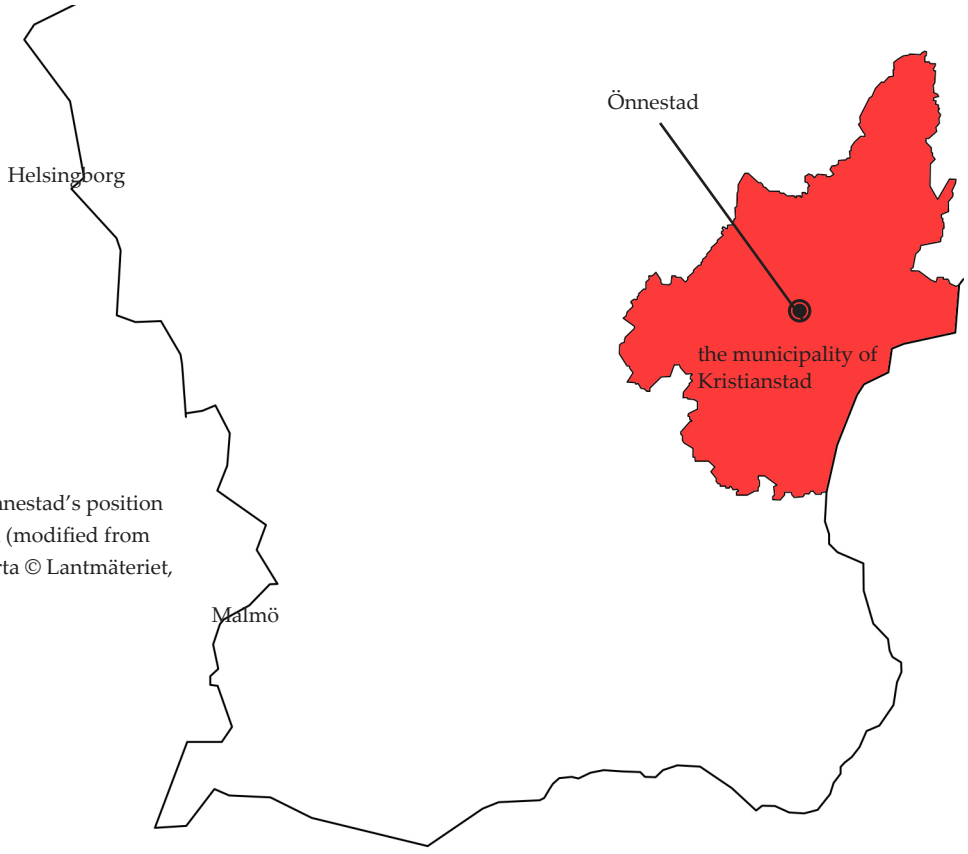


Figure 8.: Önnestad's position in the region (modified from Översiktskarta © Lantmäteriet, i2014/764).

The railroad Kristianstad-Hässleholm was routed through Önnestad in 1865. The town's community college is Sweden's first. It began its operations shortly after the opening of the railroad in 1868 (Jönsson, 1952, p. 235, 243). The former train station in Önnestad was according to the municipality closed down in 1978, due to insufficient travel usage. The former village environment is today very much influenced by the community college and the agricultural programs of the town's gymnasium 'Önnestads gymnasiet' (kristianstad.se, 2004, p. 4, 12).

In 2010 Önnestad's population consisted of 1,363 residents, with a relatively larger number of inhabitants within the age-group 0 - 19, and a fewer number of inhabitants of 60 years and older, in relation to the municipality average at the time (kristianstad.se, 2013). The business segments in Önnestad consists of small scale industries, located adjacent Hässleholmsvägen (road 21), and some allocated north of the railroad (kristianstad.se, p. 122). Statistics from 2007 reveals that within Önnestad, there were at the time about 750 work opportunities, which indicates a relatively large number of work opportunities in relation to its population size (kristianstad.se, 2013). The larger private companies that reside in Önnestad are Schenker AB and Smekab (kristianstad.se, 2013, p. 4).

According to the municipality of Kristianstad, a great deal of Önnestad's population commute to workplaces outside of the area (kristianstad.se, 2004, p. 14). Statistics from 2007 shows that around 654 professionals at the time lived in Önnestad, and 117 of them (which translates to 18 percent of all workers) had their workplace in Önnestad. The greatest outflows of commuters travelled to Kristianstad and the greatest inflow of commuters travelled from Kristianstad to Önnestad (kristianstad.se, 2013).

3.2 Future Development of Mixed-Use

Within the municipality of Kristianstad's Comprehensive Development Plan (2013), Önnestad is branded as a 'basort'. In the town future growth is expected, due to the reintroduced railroad station, which motivates development of large scale in connection to its location. This will be achieved together with mixed functions, incorporated green passages and sheltering vegetation being important elements in the new housing areas (kristianstad.se, 2013, p. 126-127). Kristianstad kommun (2013) further declares, that there are plans, in the near future, to densify Önnestad with more residential buildings, together with elements of services, along with efforts of creating living environments for its inhabitants (kristianstad.se, 2013, p. 86).

Trafikverket's (2012) illustration program associated with the railroad states that the railroad in Önnestad has been a barrier, preventing development in the north part of the town. The organisation claims that the railroad divides Önnestad into two parts, due to that housing development and public uses have been concentrated to the south side of the station location (Trafikverket, 2012).

The organisation envisioned that the train stop would contribute to modified movement patterns in Önnestad (trafikverket.se, 2012, p. 16). According to the CPD (2013), Kristianstad kommun proposes developments to be allocated both on the north and the south side of the railroad. The aforementioned plans reveal that the municipality visions Önnestad being a TOD. The proposed plans for its future could ultimately put Önnestad on the map, to constitute a significant location, where longer commuting distances are made possible, and the ability to live remote is more viable.

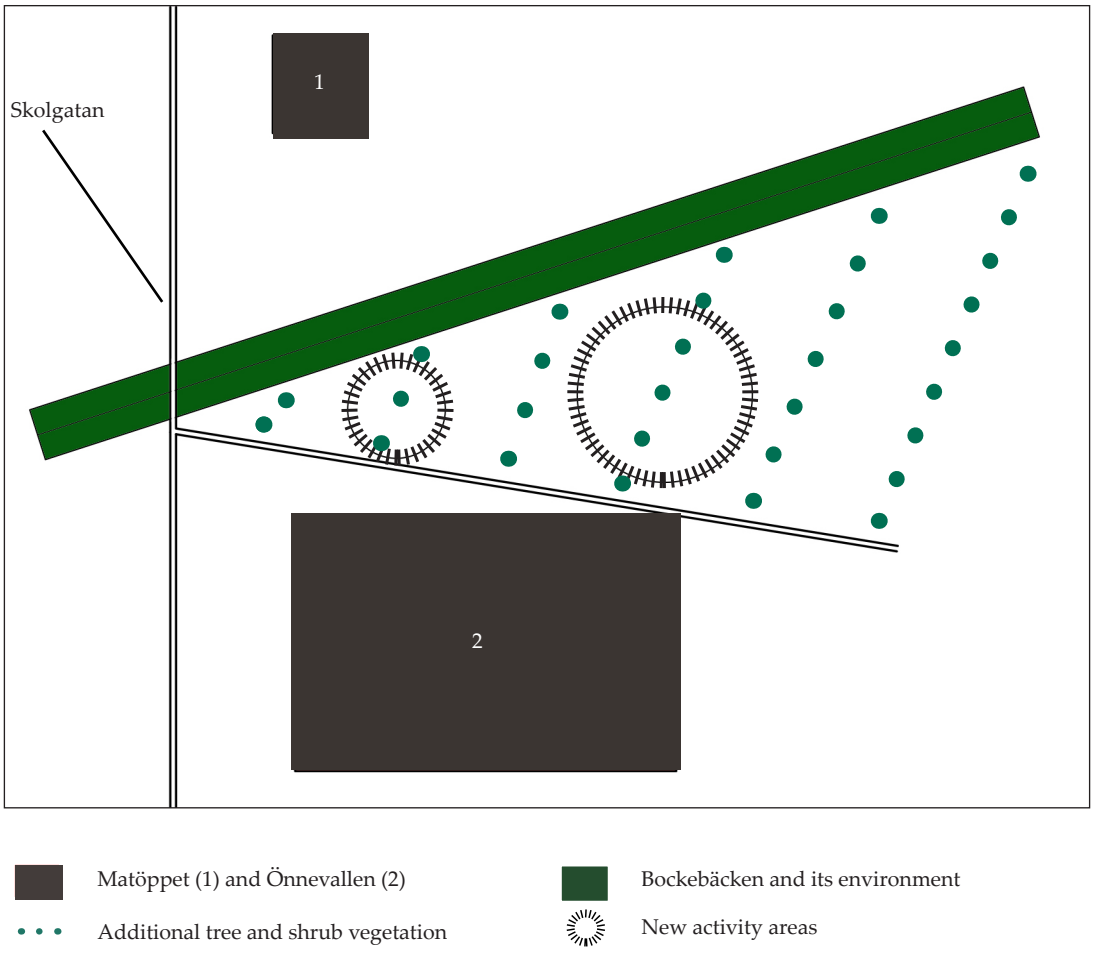
3.3 Planned Green Structure Enhancements

Kristianstad kommun (2004) points to that Önnestad's existing greenery is formed by private villa gardens, luscious green areas around its church, the surroundings of the community college, expanded park passages, situated in connection to its 1970's and 1980's single-family neighbourhoods (kristianstad.se, 2004, p. 8).

The municipality notes in the CDP (2013) that one is planning for the change that the new train stops will entail in regards to basorterna, questioning how to best take advantage of the opportunities at hand, in terms of the urban environment, passages and new developments (Kristianstad.se, 2013, p. 13). The municipality suggests green structure development in Önnestad, and proposes that more trees should be planted in the urban area's street environment, in line with proposed measures in the municipal Tree Plan publication 'Trädplan för Kristianstad', dated 1996. The municipality also adds that in connection to the station location, there are possibilities to introduce tree plantation (kristianstad.se, 2013). Krisitianstad kommun (2013) points to the Bockebäck area east of Skolgatan, which should be developed into a more functional, and accessible green belt. Moreover, the municipality states that in order to achieve a coherent park passage starting from the plains, and continuing onto the strolling area of Nävlingeåsen, a link between the green edges of Bockebäck and activities occurring in the central parts of Önnestad is needed (kristianstad.se, 2013, p. 126).

In the municipal planning document 'Nästa Önnestad!', dated 2004, it is stated that the proposed development around Bockebäck would result in new areas dedicated to leisure, and encourage engagement in various activities, adjacent two areas that are already functioning as important meeting places for the people in Önnestad (kristianstad.se, 2004). The municipality adds, that additional tree and shrub vegetation at Bockebäck will contribute to establish a varied and eventful environment (kristianstad.se, 2004, p. 8). The municipality (2004) concludes with stating that the stream area's park environment is to contain a promenade and cycling path (kristianstad.se, 2004). In the proposals concerning Önnestad's future green structure, Kristianstad kommun (2013) are clear in pointing out that the CDP (2013), is an update to the planning program, dated 2004. This means that the 2004 planning program no longer applies in regards to the municipal desired direction for Önnestad (kristianstad.se, 2013, p. 127). The author would like to argue that with respect to Önnestad's future green structure development, the planning programme speaks of this in a more imaginative and detailed manner, than what is expressed in the 2013 publication.

Figure 9: Conceptual sketch of the suggested new park environment (modified from kristianstad.se, 2004 (Ny parkmiljö mellan centrum och idrottsplatsen)).



Kristianstad kommun (2013) further explains their position in regards to design and placement, in particular residential neighbourhood design, and includes that there should be sufficient green spaces and other outdoor spaces to promote health, comfort, play and interactions amongst people (kristianstad.se, 2013, p. 42). The municipality explains that nature in close proximity to residential areas or 'bostadsnära natur', (Boverket, 2007) should exist within a distance of 300 metres of developments. The designated area should be able to host physical activities, relaxation and play (kristianstad.se, 2013). Moreover, it should be a place that could accommodate accidental meetings with neighbours and friends, and other gatherings. The municipality visions this space being for example, residential yards, zoned parkland, urban forests, or the open landscape. Requirements for the area involves strictly meeting adequate quality, and be accessible for everyone. Furthermore, the area should encompass sheltering protection by shrub vegetation, and grounds where spontaneous walking could occur (kristianstad.se, 2013, p. 55).

Regarding the spreading of fertilisers and pesticides used for agriculture, the municipality notes that bordering zones between the open landscape and the residential areas should work as buffer zones, and for urban recreational grounds in the open arable land, the advice is that these areas are developed and conserved, according to clear standpoints (kristianstad.se, 2013).

Figure 10: Analysis of the municipality's (2013) proposals. Green structure is shown as edges to the future development at the station location (modified from Kristianstad se, 2013, p. 123 (Bebyggelse (not to scale))).

The municipality stresses that if clear standpoints for these areas do not exist, the need of recreational activity grounds could be threatened, and come into conflict with other land-use procedures, once development strategies are actualised (kristianstad.se, 2013, p. 77).

Kristianstad kommun (2013) states in relation to meeting places, in the main urban areas (basorterna), that these should contain at least one public meeting place, and at least one urban park. The meeting place should promote interaction between all people, a place which can be utilised for performances, culture and leisure. An urban park could according to the municipality host such public use, and further suggests that the meeting place should in its form be representative of the urban area, and contribute to a positive identity, together with these qualities, it should be accessible for everyone and be safe to reach by walking or biking (kristianstad.se, 2013, p. 55).

3.4 Önnestad's Future TOD

It could be said that Önnestad's public uses such as its grocery shop, its school facilities, its public library, and the train station all lay within short distances inside the town, with a maximum distance of around one kilometre. Calthorpe (1993) highlights that the average walking distances to reach business areas and public transport stops, in a TOD is 2,000 feet (approximately 0,6 kilometres), which he also defines as being a pedestrian friendly environment (Calthorpe, 1993).

Önnestad has many young inhabitants, including students who commute to the gymnasium, and the community college. These groups rely on the train service being an affordable transport mode, a factor which motivates more intense rail transit services. In accordance with the TDM Encyclopedia, population groups such as students and individuals with lower income, use transit services at a more frequent basis (vtpi.org, 2014). Low-income households, as for example students, are also the type of households who is expected to choose living in TODs, according to Lehmann (2010).

Kristianstad kommun (2013) suggests residential densification measures at the station location together with public services, and a business area that in the long term would be appropriate to densify with mixed functions (kristianstad.se, 2013, p. 126). The aforementioned features go in line with TOD guidelines that comprise a mixed-use community character, where a variety of workplaces, and public applications are integrated (Calthorpe, 1993, p. 56).

According to the author of this thesis, the TOD qualities relating to the town structure of Önnestad are factors which do prove that Önnestad is already a TOD, and ahead with the municipality's future plans for the area, it will become an even more defined TOD.

4. THE ANALYSIS

The analysis aims to understand how the landscape in Önnestad is perceived visually, both through verbal interviews and observational studies. The result of the analysis is meant to give meaning behind the proposals of the conceptual ideas presented in the end of this chapter.

The landscape analysis is based on Lynch's (1960) strategy of analysing the city image. In this study the analysis is applied to the landscape. When using Lynch's strategy, certain subtractions and additions are made. The structures which are recognised from the method, and considered relevant for this study are the following:

- **Paths:** frequently used paths or movement patterns in the landscape

- **Barriers:** something which causes disruption of movement patterns, mental or physical character

- **Edges:** the borders between two different areas

- **Nodes:** strategic entry points, crossings, areas which share the same characteristics, such as centre areas

4.1 The Geography of Önnestad

Jönsson (1952) notes that Önnestad has laid at the same location for a thousand years, which constitutes a sand dune, lightly raised over the flat arable land (Jönsson, 1952). He further describes that Önnestad is made up of two different landscape types; these are the plains and the forest landscape. In the town it is mainly these landscapes, which defines the structure of the green areas.

Önnestad is situated on the Kristianstad plains, a landscape which is characterised by its wetlands, lakes, streams and coastline. The Kristianstad plains comprises of the flat agricultural landscape around Kristianstad and the southern parts of Bromölla municipality (länsstyrelsen.se, p. 72-73). Although arable land cannot be counted as part of the urban area's existing green structure, which is the advice that is claimed by Region Skåne (2012), the agricultural land however, connects to the green areas of Önnestad, and is part of the town's environment for outdoor recreation.

The plains dominate the settlement structure north of the railway in Önnestad and its surrounding areas. Farms lay scattered like islands, embedded in the agricultural landscape of the plains. With its surrounding vegetation, they create smaller structures of space, while the scale of the arable land is defined.

Figure 11: The different landscapes (rough sketch modified from kartor.eniro.se (not to scale)).

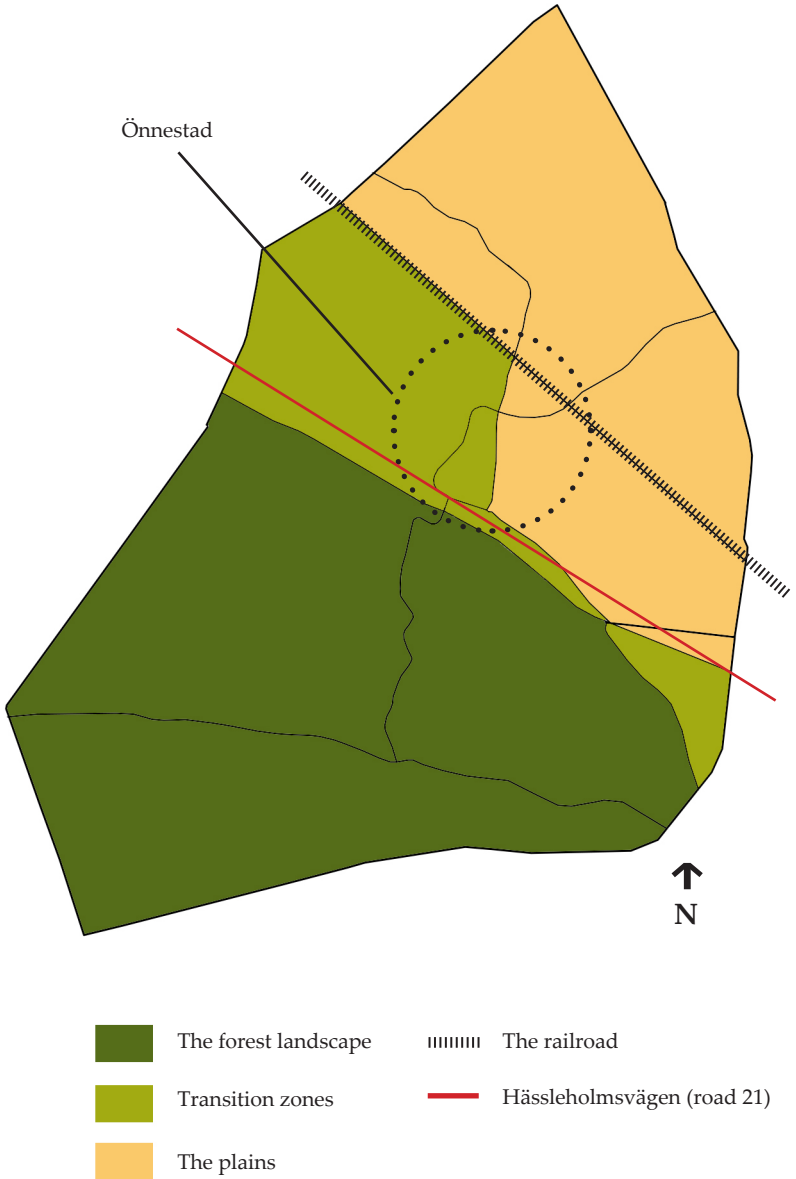


Figure 12: The arable land north of the railroad in Önnestad, with an adjoining dirt path and farms lying scattered in the land plains (Photo: the author).

At Önnestad's southern borders, lies the forest landscape of 'Nävlingeåsen', which extends into the southern parts of the town (kristianstad.se, 2013, p. 122). The forest landscape covers the south part of Önnestad from the location of the motorway 'Hässleholmsvägen' (road 21). Inside the forest landscape lays the natural/ recreational area 'Bockeboda fritidsområde'.

The forest landscape consists of dense forest, scattered settlements with land dedicated for grazing animals. Landscape features are formed by larger coherent green spaces of vegetation. Additional structures are established by green areas consisting of open space surrounded by the dense tree vegetation. This space is experienced firstly when one stands at the edge of the surrounding forest.

Figure 13: Farms located at Bockeboda fritidsområde, the grazing land forms open space structures adjacent the dense forest landscape (Photo: the author).

Figure 14: The dense forest forms larger coherent structures of green spaces in the landscape (Photo: the author).

The two landscapes are separated by the fault scarp of the ridge Nävligeåsen, with its crystalline bedrock and the limestone foundation of the Kristianstad plains (Jönsson, 1952, p. 5). Inside the town flows the stream Bockebäck, its properties represents small-scale green areas, with scattered tree vegetation, which increases the sense of space in Önnestad.

Figure 15: Bockebäck with its vegetation, piercing through the south parts of Önnestad, establishing a series of small-scale spaces (Photo: the author).

In the town, smaller and contained green spaces are formed by the many private villa gardens. Structures of linear character are created by green passages, positioned in-between or next to the villas. A few of the passages extend into areas of larger open space, which lay huddled inside the neighbouring areas. The grounds of the community college mark an example of such a green open space (fig 19).

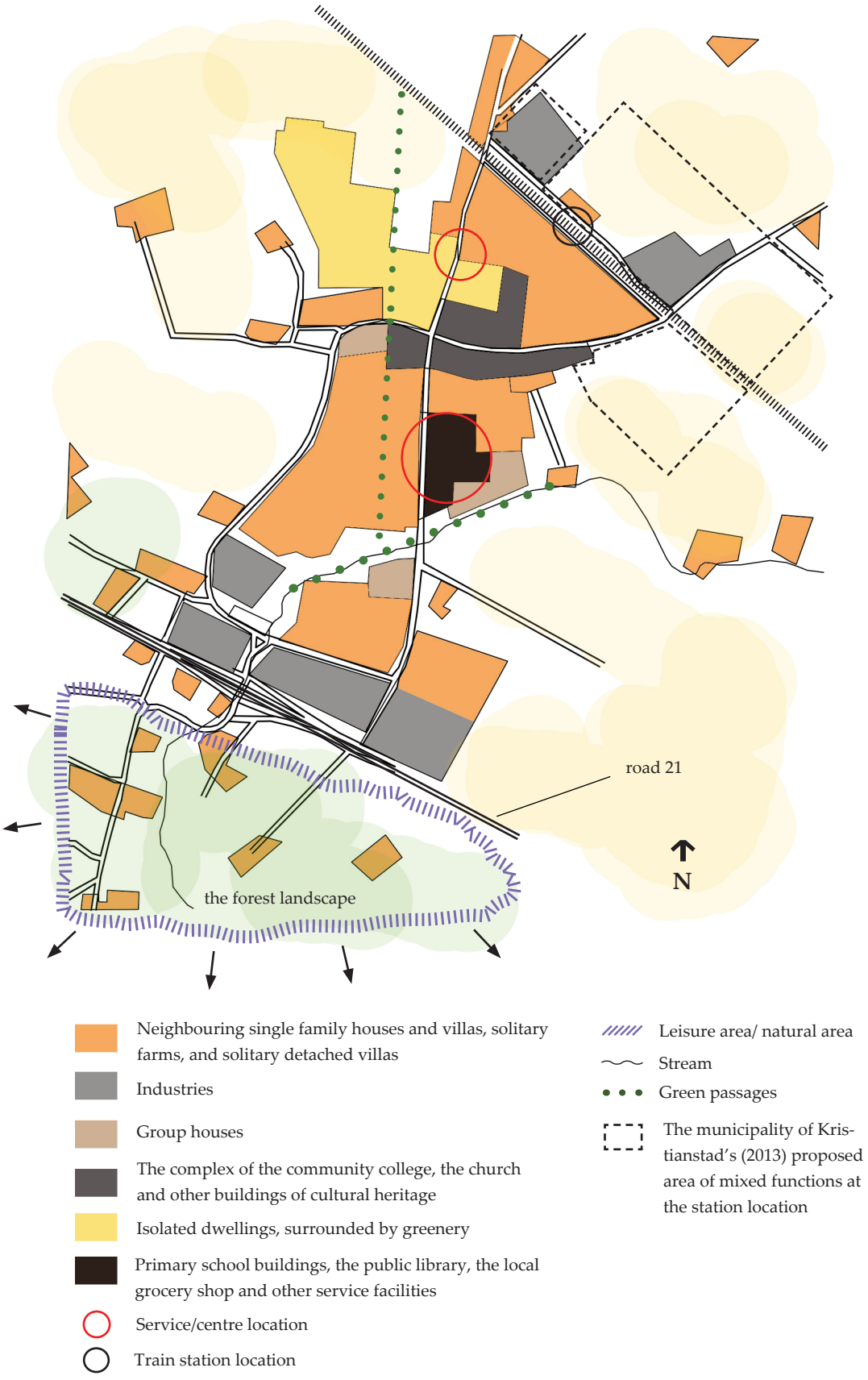
Figure 16 and 17: The green passages in-between the private villa gardens (Photo: the author).

Figure 18: Another green passage leading to and from the church and the surroundings of the community college (Photo: the author).

Figure 19: The grounds of Önnestad's folkhögskola, which incorporates a large open public space (Photo: the author).

Land-Use Map

Figure 20: Overview of Önnestad's present settlement structure (modified from kristianstad.se, 2013, p. 123 (Bebyggelse (not to scale))).



4.2 Paths of Importance

Önnestad has two main streets, Skolgatan and Byagatan. Jönsson (1952) explains that historically the settlement structure in Önnestad consisted of farms, which were built close to each other, grouped along the common road Bygatan. The municipality (1982) adds that the building procedure entailed, among other things, an adaptation to climate and energy saving (Kristianstads kommun, 1982, p. 2). Jönsson (1952) states that the farms were enclosed by a gateway, production facilities such as warehouses, barns and garages, and dung stead, which lay in close proximity to Bygatan. Between the buildings lay a square courtyard, which usually had a well and grounds paved with cobblestone (Jönsson, 1952, p 16).

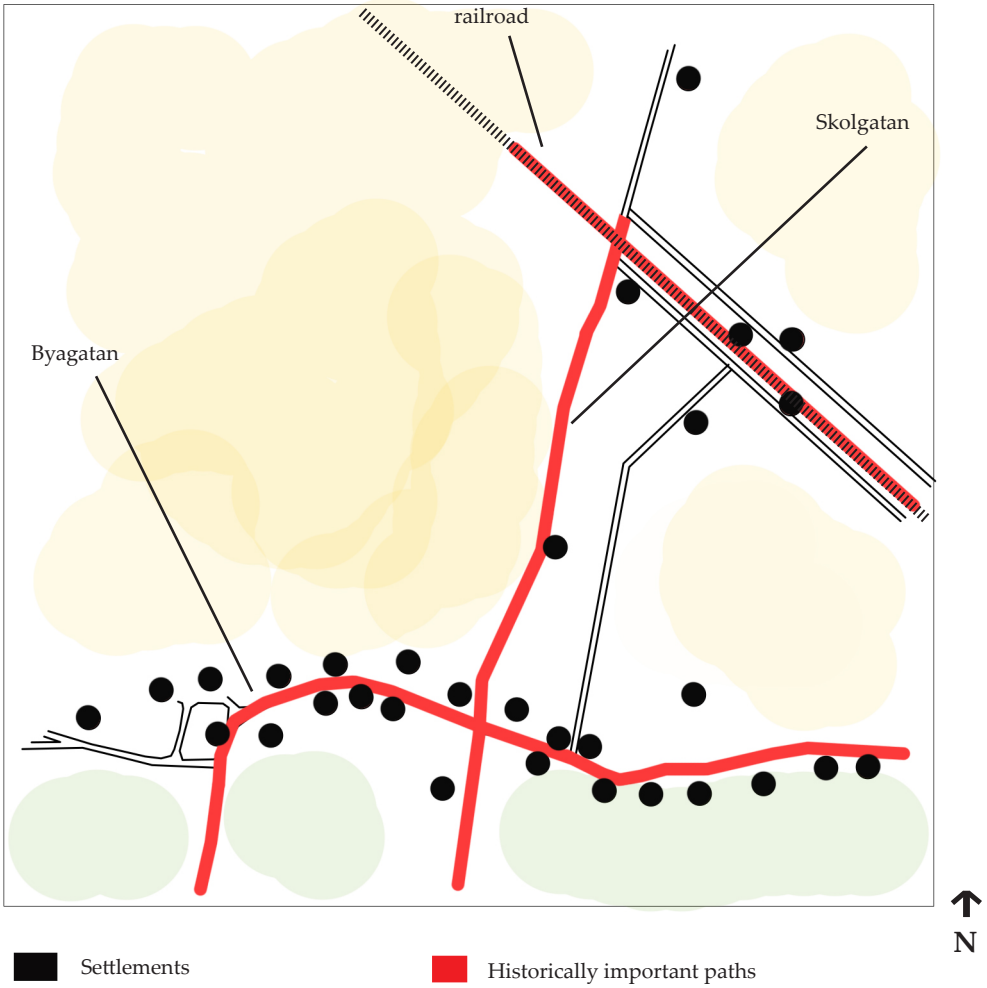


Figure 21: Historical overview of Önnestad's spatial settlement structure in the late 1860s (modified from Persson, 1926 (Önnestads By (not to scale))).

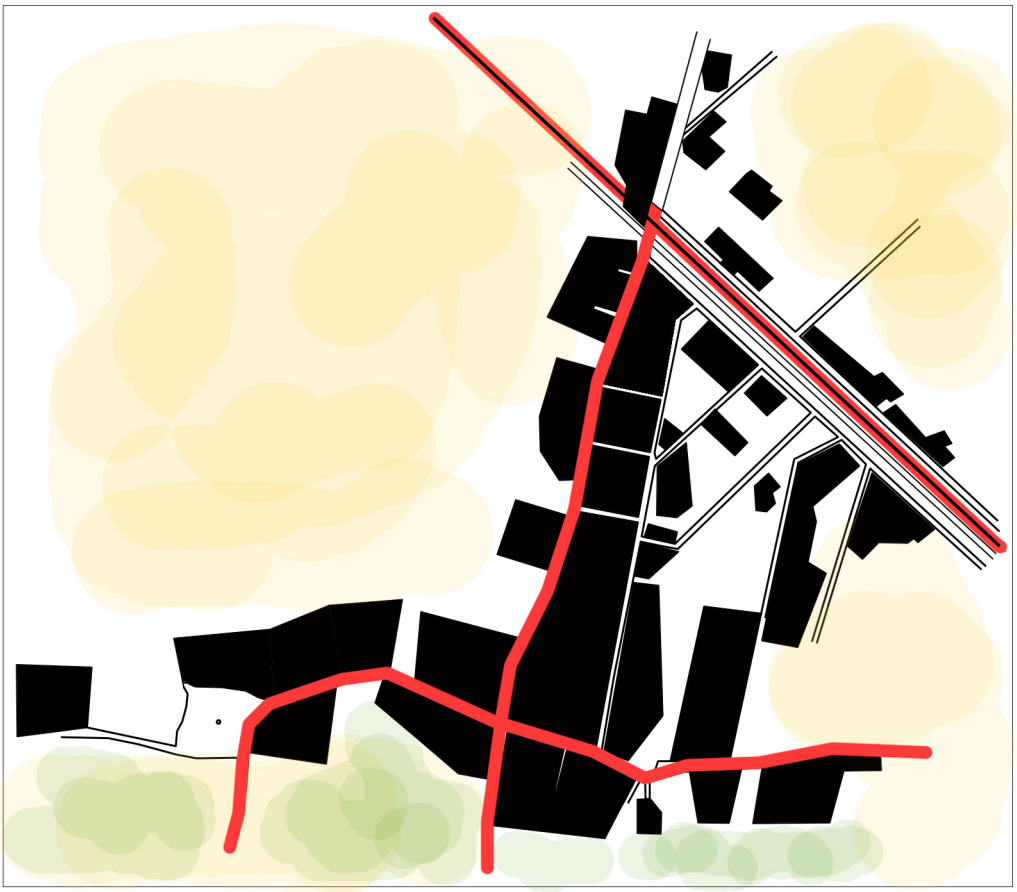


Figure 22: Historical overview of Byagatan and Skolgatan's settlement structure in the early 1920s (modified from Persson, 1926 (Önnestads By (not to scale))).

Most farms had garden plots with bushes and fruit trees, cabbage cultivation and hops groves (Jönsson, 1952, p. 16). Jönsson (1952) further claims that the unguided development strategies in Önnestad achieved consistency and order with the local municipal society established in 1934, and its developed town plan (Jönsson, 1952, p. 247-249).

Byagatan forms an arc around the residential areas on the southeast side of Önnestad, it continues via the centre, where its intersected by Skolgatan, and is then steered towards the northeast of Önnestad. Byagatan carries the majority of traffic through the urban area. Skolgatan has a more straight forward path in relation to Byagatan. It runs from the southwest to the northeast of Önnestad (kristianstad.se, 2013, p. 124). In the south, road 21 (Hässleholmsvägen) connects Önnestad with Hässleholm and Kristianstad.

Both Skolgatan and Byagatan end at the railroad intersections in the north part of Önnestad. Where Byagatan ends in the north, the road continues as 'Färlövsvägen', which leads to the nearby area Färlöv. A subject interviewed at Focks väg (the road which is located adjacent the southern entrance of the station) suggested that there should be a cycle path to Färlöv from Önnestad. Moreover, the subject stated:

'.....the municipality has discussed the introduction of a cycle path connecting Önnestad and Färlöv for many years, but it has yet to be realised' (Location: Focks väg (interview translated)).

The subject further explained that many residents in Önnestad have requested this cycle path to be instated because many children who goes to school in Färlöv resides in Önnestad, and the other way around.

When the interviewees were asked how they make use of the outdoors, several spoke of the agricultural gymnasium's surroundings, especially the dirt roads located next to the horses paddocks, which they stated to be used for promenades purposes and/or walking their dogs. Other individuals spoke of promenade paths located at the newly established playground opposite the grocery shop, which is mainly also used for this intent. The railroad station is used by a few of the interviewees, although strictly for work related commuting purposes. One subject who was a long-time resident noted to merely making use of the community college's outdoor environment, as a transportation route to reach the station location. Bockeboda fritidsområde (the forest landscape in the south), was another place which was frequently mentioned by the interviewees. Regarding this area, the interviewees, where consistent in stating that they use it mostly to walk on the designated tracks. Many of the interviewees mentioned walking on the dirt roads next to the arable land north of the railroad.

Figure 23: The promenades surrounding the new playground (Photo: the author).

Figure 24: Commuter bicycles left at an undefined green area adjacent the train station (Photo: the author).

According to most of the interviewees, walking was the main mode of transportation inside the town. This means that the paths in and around Önnestad are important structures. Those who merely visit the area on a daily basis, mentioned to only walk from point A to point B. The residents of the area spoke of interconnected paths, and explained where these were allocated. A few of these individuals said that they complement their walking with biking in the area. Quite a few of the subjects indicated that they mainly make use of the areas in the north of Önnestad, to walk their dogs.

A handful of the individuals mentioned that they walk from their homes located in the south part of the town, through the main road Skolgatan, to reach the agricultural dirt roads in the north. Other subjects mentioned walking only on the paths surrounding the town to reach their point of interest, a few of the subjects stated that they cycle to navigate around the area.

In Önnestad, walking is an activity that frequently occurs on the grass and/or on the gravel next to the sidewalk, instead of on the actual pavement. What can be registered is that there are shortcuts established in the town. There is for example a shortcut leading up to the grocery shop, which establishes a direct route to the point of interest (fig. 25).

Figure 25: People form their own paths inside the town. One of the paths beside Bockebäck, with the adjoining shortcut leading up to the local grocery shop (Matöppet is shown encircled) (Photo: the author).

Figure 26: Shortcut heavily utilised located beside Byagatan, partly making up for the missing sidewalks at Byagatan, shown in figure 27 (Photo: the author).

Figure 27: The sidewalk terminates at Byagatan, with shortcut established beside the neighbourhood, shown in figure 26 (Photo: the author).

Another noteworthy observation is the way in which people adjust to the poorly managed sidewalks in the town. For instance, in situations where the vegetation is growing outside of the villa gardens onto the already narrow sidewalk, one simply crosses and start walking on the other side of the street.

Another related type of behaviour is how people use the roadway in the town. The neighbouring streets in the residential areas are narrow, and sidewalks are missing (except on the main street Skolgatan), which is something that actually contributes to more democratic streets in the town, where people walk in an unstructured manner. This is a behaviour which can be compared to a pedestrian landscape; a phenomenon also identified by Gehl (Gehl, 2010, p. 139).

Because many people choose to mainly walk in the township of Önnestad, traffic on the narrow streets inside the town is slow at most times. However, at the same time, the missing pavements could contribute to a less safe environment, less orientable, together with a less accessible outdoor environment. From an observer's point of view, it appears that pedestrians simply adapts to the situation in Önnestad.

Figure 28: Missing sidewalks at Mellanders väg, the road leading down to the train station location, from the community college (Photo: the author).

Figure 29: Overview of Önnestad's paths derived from interviews and observations (modified from kristianstad.se, 2013, p. 123 (Bebyggelse (not to scale))).

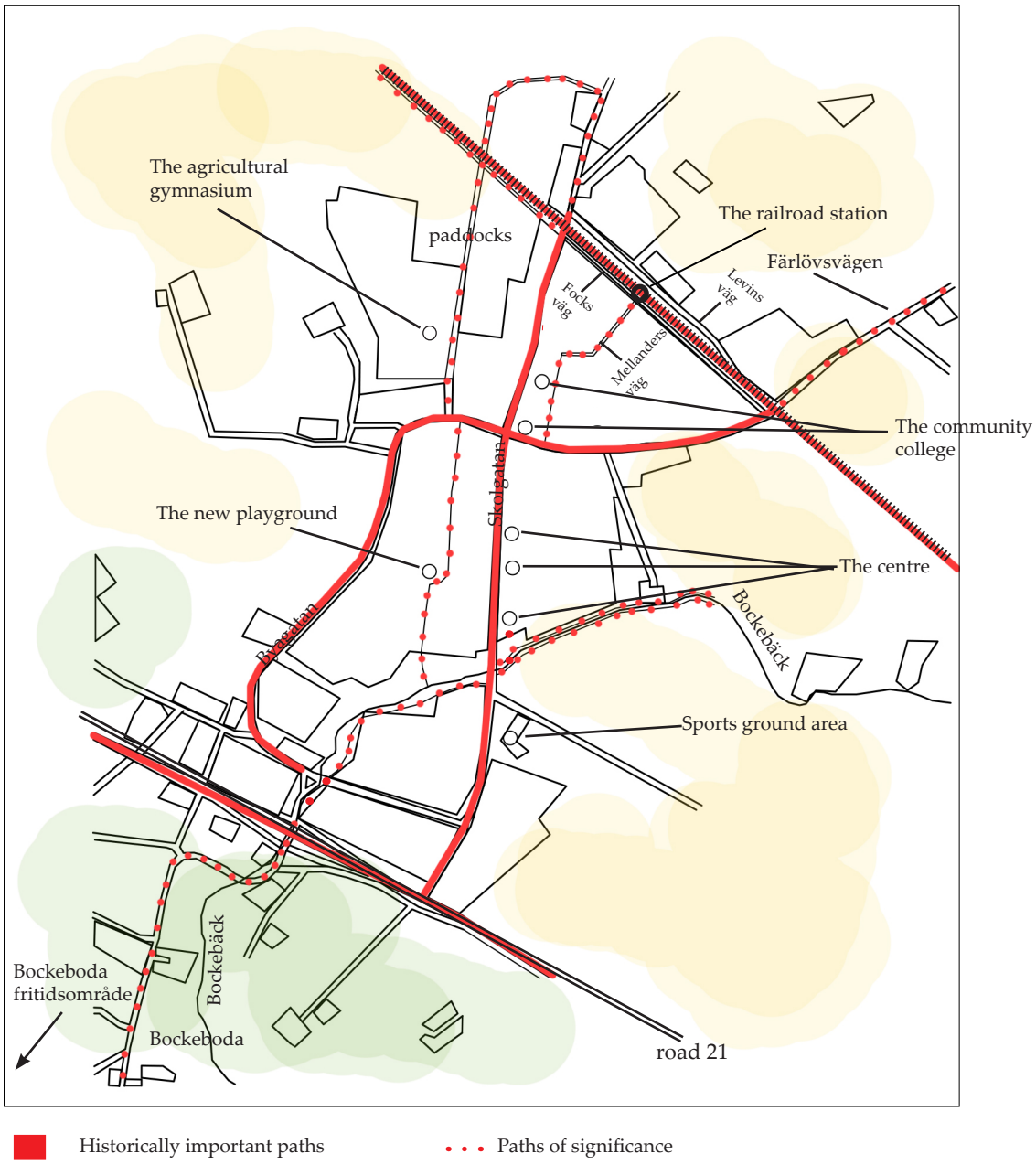


Table 1: Overview of the green structure qualities in relation to paths in the landscape.

Strengths	**Weaknesses**	**Future requirements and potentials**
- Historical paths help establish identity to the area - Paths interconnect - Consists of green passages - Offers views over the open landscape	- The pedestrian environment is inadequate - Ground surfaces makes walking in the area less accessible for the elderly and people with other ability issues - Ends abruptly/cut off by road	- Create walkable environments to coincide with TOD guidelines - Sustain democratic street behavior by forming pedestrian landscapes - Make green passages more accessible - Links between green passages

4.3 Barriers of Mental and Physical Character

In regards to the spatial experience in Önnestad, Kristianstad kommun (2013) states that the railway in the north part of the town, creates a barrier for movement patterns. Trafikverket (2012) also insists, as mentioned earlier, that it has been a barrier, which have hindered development in this part of Önnestad.

There are only two main crossovers to reach the north part of Önnestad. These are situated at Byagatan and Skolgatan. Through field observations, a third crossover can be found adjacent the agricultural gymnasium, which leads to the north part of Önnestad. The crossover lies on a dirt road next to the horses' paddocks, which constitutes accessibility problems.

Figure 30: The third crossover, located at the horses' paddocks (Photo: the author).

There are no direct walking routes from the station area to the central part of the town. An interviewee said they walk via the community college's grounds, to reach the station area. To be able to walk or cycle to the station from the central part of Önnestad, one must either travel via Skolgatan, which constitutes a detour, or one could chose to walk via the community college, as noted by the interviewee. In order to take this route, one must be able to navigating oneself via the smaller roads of the neighbouring areas, which requires some navigational skill and previous knowledge of the area.

Another issue worth mentioning, in relation to the spatial experience in Önnestad, are the two entrances to the town, from the route of the train. These appear indistinct to the eye, and due to the noise barrier, (located at the south side of the tracks) the direct contact between the railroad and the south part of the town is lost, which constitutes both a physical and a mental barrier for orientability and identity in Önnestad.

Further barriers related to movement patterns were Färlövsvägen. This road, as mentioned previously, lacks a cycle path to reach the nearby urban area Färlöv. In order to reach Färlöv by bike, one has to cycle on the roadway which is narrow, lacks a shoulder, and has a speed limit of 70km/h.

Figure 31: The noise wall at the south entry to the railroad station. It is an obstacle which hinders direct contact with passing byers, and visitors arriving from the route of the train (Photo: the author).

One subject suggested that the recently established promenade around Bockebäck needs to be paved, because the accessibility for older people, and people with disabilities is not adequate at this place. In relation to this suggestion, the interviewee referred to a scenario at the promenades and noted:

'...a wheel chair got stuck in the gravel of the new path surrounding Bockebäcken, and slid down towards the stream.' (Location: the area in-between Bockebäck and the local grocery store (interview translated)).

In relation to the incident, the subject noted that all environments should be available for everyone, not only for healthy people. Another person complained that the municipality has removed the fence around Bockebäck, which is a safety issue for children playing in the area.

For most of the residents of Önnestad, the paths in the north part of Önnestad, were noted as being the most used routes to move around in the outdoors. It was clear from the interviewees that the distance to travel to and from the forest landscape of Bockeboda constitutes both a mental and a physical barrier. One individual explained that a bus interchange area was recently built in connection to road 21, together with an underpass, linking Önnestad with Nävlingeåsen and Bockeboda. The underpass consists of a roadway, pedestrian and cyclists paths, and a horse trail. It is the closest entry to the natural forest area, which means road 21 is another barrier for movement in the area. The distance to Bockeboda fritidsområde from the underpass location is approximately 3 km, another ordeal is that the route lacks a direct bus link. These factors make it inaccessible for elderly, disabled people, children, and those who either owns a car or a bicycle. Further obstacles in order to reach the forest landscape, are the industries lying in connection to the road, which form large blockages, hindering outlook and alternative movements patterns to this area.

Figure 32: The interchange, ahead is the road 21, and the underpass leading to Bockeboda (Photo: the author).

Figure 33: Barriers in the landscape, derived from interviews and observations (modified from kristianstad.se, 2013, p. 123 (Bebyggelse (not to scale))).

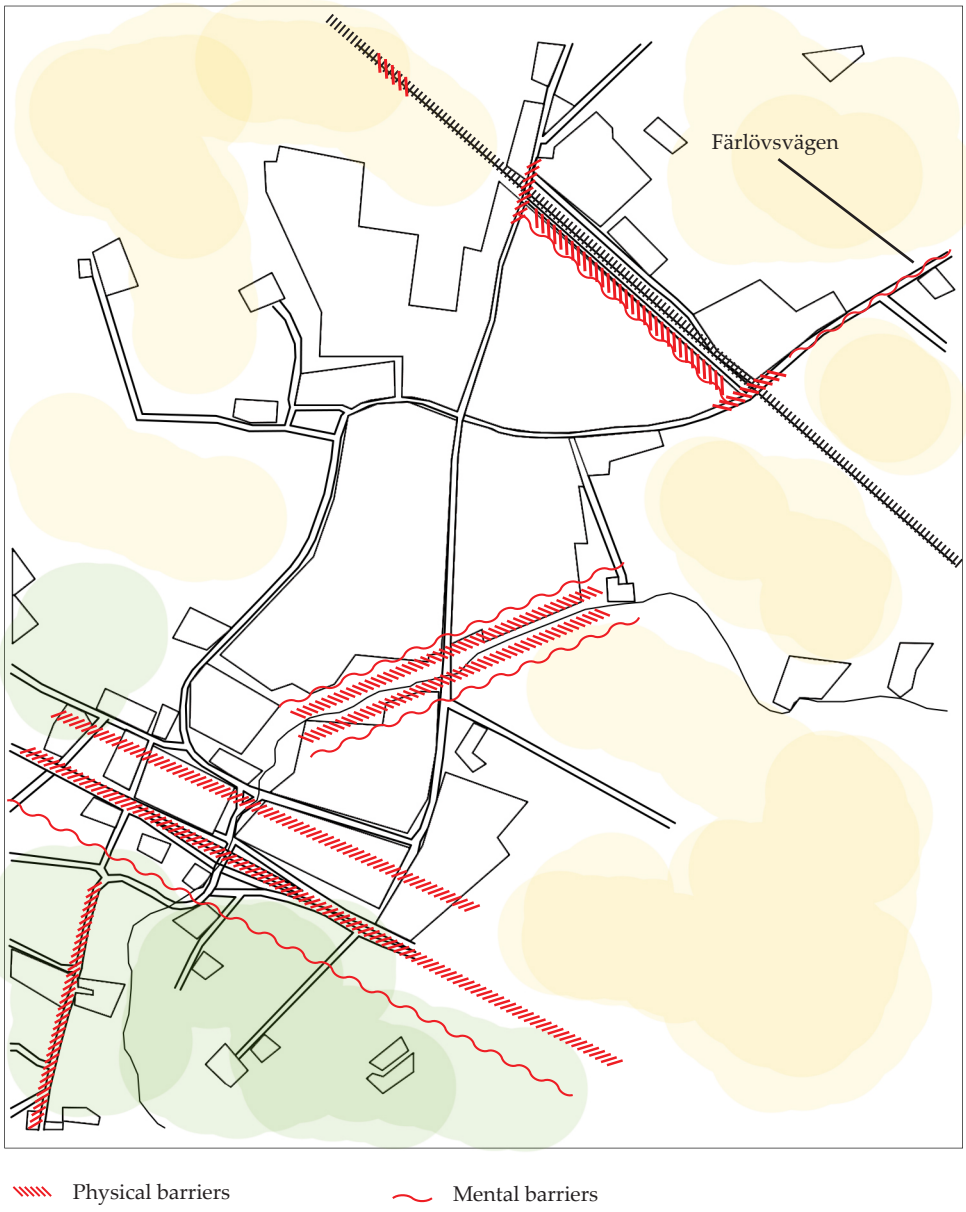


Table 2: Overview of the green structure qualities in relation to barriers in the landscape.

Strengths	**Weaknesses**	**Future requirements and potentials**
- The train station opens up for development in the northern part of Önnestad - The underpass establishes a connection to the natural forest area - Promenade paths have been laid at Bockebäck	- The distance to the leisure area makes it inaccessible for many - A direct route to the train station location is missing - The promenade paths at Bockebäck lacks in accessibility	- Increased accessibility to green spaces, to break down the mental and physical barriers - Establish available green areas in the north in connection to municipal future proposals - Mitigate barriers in the landscape

4.4 Green Edges and Connectivity

In the south of Önnestad, road 21 and the industries together establish a bottleneck in the landscape preventing green connections with the town's settlement structure. The surrounding arable land supplies patches of greenery, which are concentrated to the scattered farms immediate surroundings. In the north part, the arable land use hinders green structure development, providing only one single function. Inside the community, green edges are supplied by Bockebäck and the agricultural gymnasium's surroundings.

One of the subjects expressed their will of having green areas in closer proximity to the town. Another individual, who was a resident of Önnestad, and who said they often walk their dogs in the area, stated that the outdoor environment in Önnestad do not qualify for a varied environment. The subject further highlighted that there is no forest inside the town, there is primarily farmland. The individual wishes there were more greenery in the town for promenades. The subject pointed out that the green areas in Önnestad are not connected, and more work could be done to improve the conditions. The interviewee stated:

'...one can improve conditions in the context of greenery, if there is a will to improve it' (Location: outside of Matöppet (interview translated)).

Boverket (2007) explains that it is a requirement for green structure, as with all other structures, to be connected. Moreover, the authority further explains that if green areas are isolated, it can lead to worsened conditions in terms of developing and preserving the qualities of the areas (Boverket, 2007, p. 21-22).

The authority stresses the importance of strengthening the accessibility and orientability of greenery in connection to residential areas, which the authority believe could be achieved through establishing meeting places, green corridors and by eliminating obstacles in the landscape (Boverket, 2007). The authority point to the importance of making the perceived and the actual accessibility exposed regarding the planning of greenery in relation to housing areas. The act of observing how people perceive the access of these areas in the physical planning is key, according to the authority, along with paying attention to aspects such as orientability (Boverket, 2007, p. 41).

In the municipality's proposals for development in the north of Önnestad, the new green structure is envisioned located merely surrounding the new settlement structure, which could be argued hardly makes up for sufficient green areas in the north in comparison to resources available in the south.

Figure 34: Green edges and connections in the landscape, based on observations and interviews (modified from kristianstad.se, 2013, p. 123 (Bebyggelse (not to scale))).

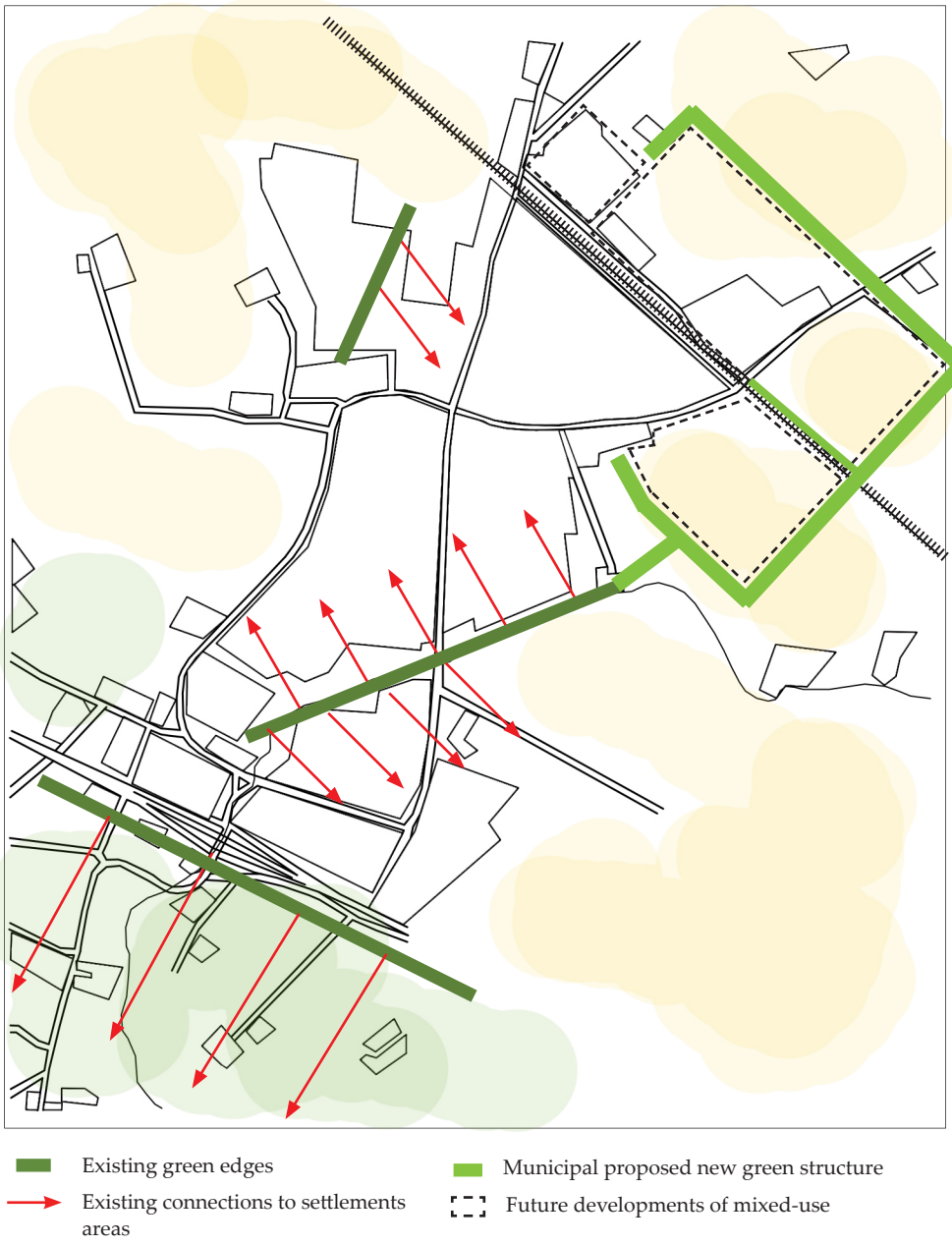


Table 3: Overview of the green structure qualities in relation to edges and connections in the landscape.

Strengths	**Weaknesses**	**Future requirements and potentials**
- The existing green edges of Önnestad has open space layout's providing views of the surrounding arable land - Bockebäck supplies the south part of the town with green edges - The agricultural gymnasium's surroundings provides an important green edge in the north	- Road 21 and the industries in the south form a bottleneck in the landscape, thus preventing green structure connections - Existing green edges lack in the north, due to the nature of the land - The distance to the forest landscape	- Green areas are needed in the north to balance the loss of land dedicated to densification at the station, and to ease the lack of existing green edges in the north - Establish connections between the north of Önnestad, and the forest landscape in the south - Increase accessibility to green areas

4.5 Nodes and Places of Navigational Importance

The important places in Önnestad are according to the interviewees the local grocery shop 'Matöppet', the new train station (which has already become a vital place in the town), the public library, the new play-ground, with its surrounding promenades, the community college's surroundings, and the dirt roads in the northern part of Önnestad. Bockebäck, Önnevallen, and Bockeboda are nodes in the landscape that are frequently recurring elements, identified and described by the interviewees. One interviewee pointed out that the greater northern parts of Önnestad, and the areas surrounding Önnestad are important places in the landscape.

One interviewee had some opinions regarding the development of the new train station. The subject stated:

'...the immediate railroad area needs more greenery, such as flowers, trees and other plants' (Location: Mellanders väg (interview translated)).

By analysing the development of the immediate station area as an observer of the area for a longer period of time, it is clear that not much effort has been made towards either making the area an attractive place to spend time at, or a distinct space in the landscape. The only progress that can be noted from the site, is an investment in plant containers, with a sparse amount of vegetation (fig. 38-40).

Figure 35: The south side entry, which lies opposite Focks väg, March 2014 (Photo: the author).

Figure 36: The station area, looking west over the south and north side of the tracks, April 2014 (Photo: the author**).**

Figure 37: The station area at Focks väg, June 2014 (Photo: the author).

Figure 38, 39 and 40: The south side of the station environment, adjacent Focks väg. Empty plant containers, small scale use of greenery, and hard surfaces which dominates this space, July 2014 (Photos: the author).

Lynch (1972) raises an interesting point when he explains that from time-to-time, it is usual that humans seek to have an influence on the timing of happenings. He refers to the most important parts as being the beginning and the end of a process, further stating that we are in need of directional assistance, to be able to judge what type of pattern suits the situation best in relation to timing. He relates this statement to the way building processes are scheduled. For example, one needs to coordinate different activities and tasks, to ensure that resources are utilised efficiently and overall maintain a steady pace. Lynch (1972) continues with pointing out that the utilisation of scarce space or the timing of public services, is scheduled too, which can contribute to that the timing for other activities, are affected and treated as secondary (Lynch, 1972, p. 73).

In relation to the deficiency of greenery at the station location in Önnestad. One could argue that greenery as a key feature at Önnestad station location is lacking today, and greenery is treated as a secondary attribute at least for the time being. When revisiting the station area in October 2014, it was obvious that no further improvements had been made with the green structure of the area, no trees had been planted, nothing had happened.

When the author of this thesis contacted the municipality in March 2014, and again in August 2014, regarding green structure development at the train station, the municipality's planning department explained that there at the moment do not exist detailed plans, that are specifically targeted towards the green structure development of the new train stop in Önnestad. However, the municipality are planning for residential development in Önnestad, due to an expected demand for housing. One had discussed the possibility of introducing greenery in connection to the station, for example a park at the station location, but there were no money that could finance the development within the municipality, and the region did not invest (Kristianstad kommun, 2014).

In the town of Önnestad there is a lack of places where people can relax, gather and converse at. This is something that the municipality has reflected on in their CDP (2013), in regards to the proposals for Önnestad's future development. When observing activities in the urban landscape, one can spot that for instance, next to the local grocery store that a few young people sit and/or lean at the edge zones of the place.

Adjacent Matöppet lays the primary school, and as a result of that, the location of the store and its surrounding area becomes a place where the students socialise, without having to encounter their lecturers while having a direct outlook over the school yard. Outside the entry to the grocery shop, a billboard is located, attached to it are posters which publishes events in the community. Through 'anslagstavlan' (the billboard's so-called name in Önnestad), information can be retrieved about social and recreational activities occurring in the urban area. While the author was taking part in the urban environment at this place, observations were made which noted the behaviours of people in the area, and at all times there were customers who glanced at the board when one arrived or left the store.

Figure 41 and 42: The local grocery shop, at the centre of Önnestad with its billboard shown in figure 42 (Photo: the author).

The children who are outside playing in the area are making use of the public space to a great extent. They play games in the passages between the single family houses, at various left-over spaces in the neighbouring areas, and at the train station. The places they play at are often areas where they can be spotted by other playmates, and places that are central in Önnestad, which supports Gehl's (2010) theory regarding the importance of visual connections in neighbourhoods and their importance for the outdoor environment (Gehl, 2010, p. 61).

Figure 43: Nodes in the landscape, derived from observations and interviews (modified from kristianstad.se, 2013, p. 123 (Bebyggelse (not to scale))).

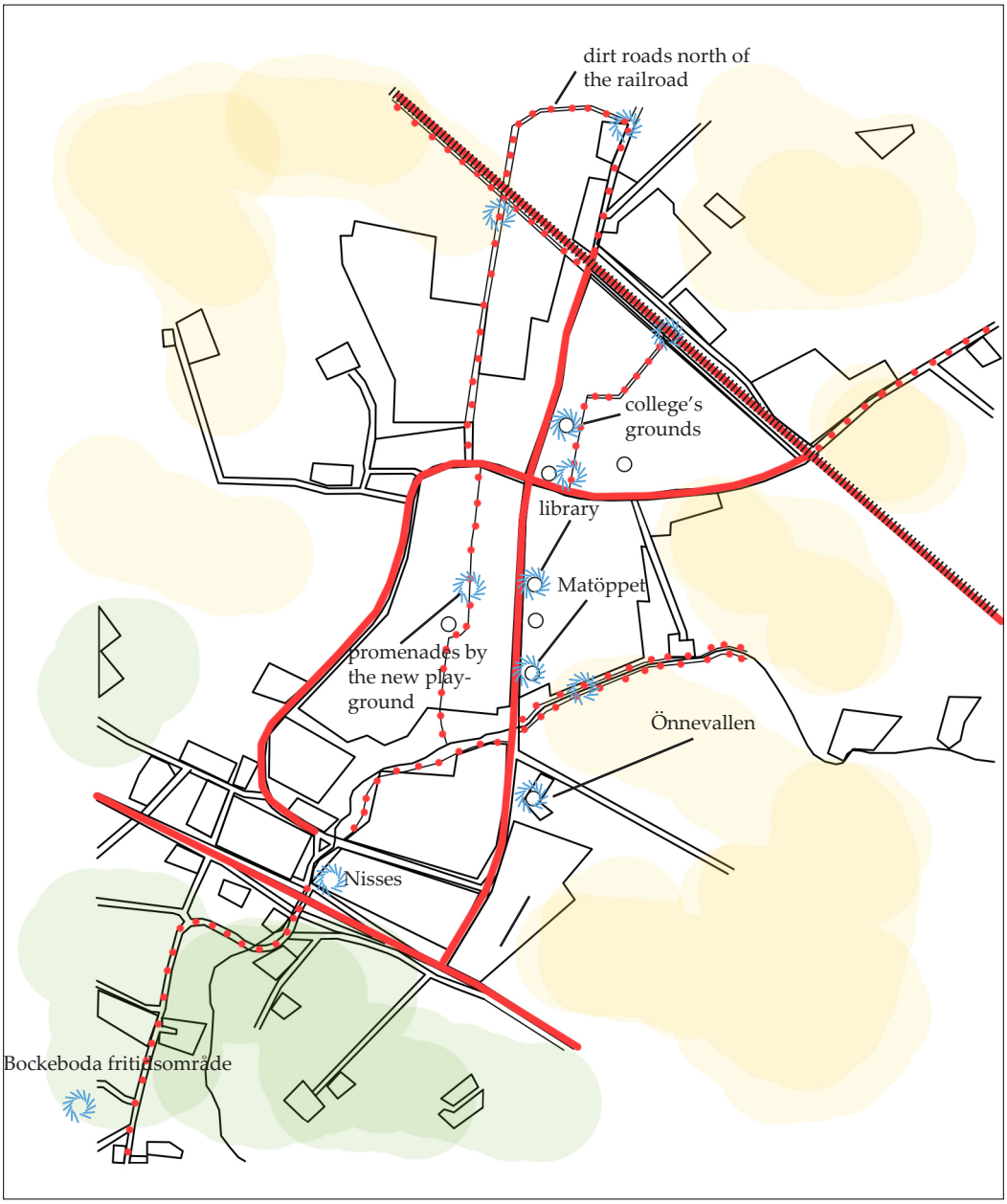


Table 4: Overview of the green structure qualities in relation to nodes in the landscape.

Strengths	**Weaknesses**	**Future requirements and potentials**
- Most nodes lie within short distances apart - Located at or in connection to important paths in the landscape - The forest landscape is valuable for recreational purposes	- The long distance to the forest landscape - Deficiency of greenery in connection to nodes in the north - Nodes do not offer adequate amounts of outdoor activities	- Additional greenery is required at the station, to make this area a more attractive, varied and more usable environment - Multi-functional green structure areas are needed, to supply a range of activities

4.6 Conceptual Ideas

The spatial analysis identified a number of challenges and issues surrounding the green structure in Önnestad. The analysis found that it is of great importance for the municipality to address these issues in regards to future densification plans in Önnestad. In chapter three, the municipality's strategies for developing the green structure in Önnestad were reviewed. The conceptual ideas address an alternative strategy of planning for green structure in Önnestad.

The spatial analysis, which identified paths, barriers, edges and nodes in the landscape, assisted in gaining an insight into the strengths, weaknesses, future requirement and potentials with the existing green structure of Önnestad. The analysis brings to light, that there is a clear deficiency of green structure in the northern part of Önnestad. There are barriers in the south, which hinders movement patterns and decreases the accessibility to the forest landscape. The barriers also disrupt possible green structure connections between the north and south of Önnestad.

The plan was to make use of the knowledge gained from the secondary, together with the primary research, to help build arguments for where development and improvement of green structure is needed in Önnestad. Objectives for the ideas were (1) to address the deficiency of green structure in the north of Önnestad, (2) balance future land loss, and (3) introduction of multi-functional green areas.

4.6.1 Strategy

- Green areas of various scales are needed in the north of Önnestad, to subside for the lack in green structure features, the distance to Bockeboda fritidsområde, and the barriers for movement.
- Balance future land loss, devoted to the municipal future plans of developing Önnestad with mixed-use.
- Establish multi-functional green structure.
- Increase accessibility levels to green areas.

4.6.2 Proposed Green Structure Planning for Önnestad

The conceptual ideas are based on theory relating to TOD, the municipality of Kristianstad's future development proposals, theory of social aspects, along with the empirical study conducted in Önnestad. The proposal consists of three areas.

Area (1):

Is located north of the railroad, above the municipality's future planned development. In this space, I would like to propose the introduction of an urban park, which should not be tied to one single usage mode, it should encourage multi-functional use. It should be a place that is accessible for everybody, independent of ability. Inspiration is drawn from TOD guidelines regarding open space resource, and the municipal recommendations for urban parks in basorterna.

Area (2):

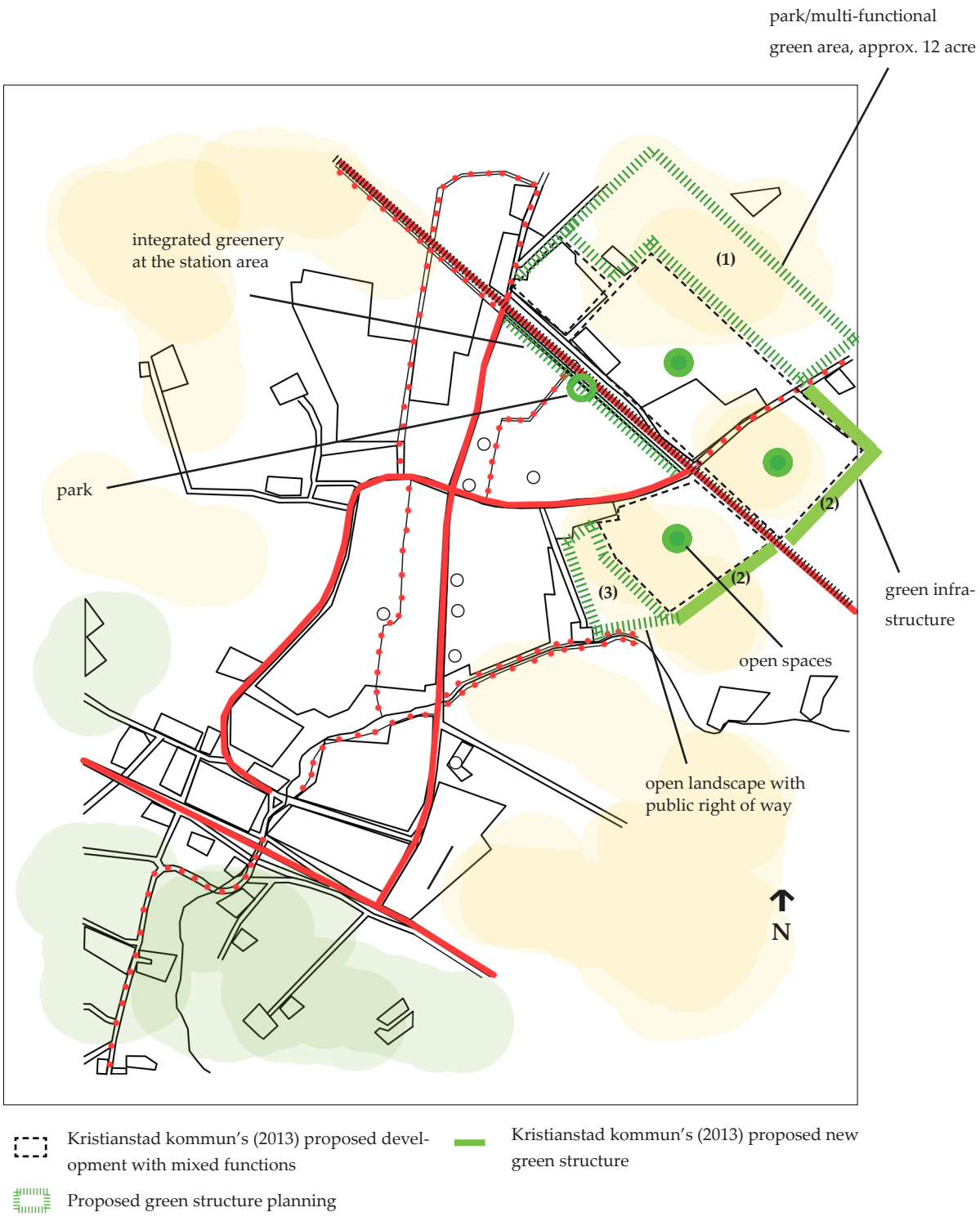
Is part of the municipality's proposal for new green structure areas. The area should feature green passages with incorporated green infrastructure for stormwater runoff that also provide public access. This is inspired by a Green TOD approach to planning, which supports two-fold functions of greenery.

Area (3):

Is located south of the railroad, below the municipality's future planned development area. This area is connected to Bockebäck, and therefore it could be connected to the paths surrounding the stream, forming a trail reaching from the south to the north part of the town. It should feature an open space landscape character, and could possibly host a dog resting area, and/or other activity areas. The qualities of this area is influenced by Calthope's (1993) ideas of trails allowing public access to open space and providing paths to destinations along the edges of linear parks and settlement areas.

Municipal ideas regarding integrated greenery at the station location should be re-addressed, along with the reviewing the possibility of introducing a park adjacent the station. Open spaces inside the proposed settlement areas could be applied, to further address the need of green areas, and meeting places in the town. Inspiration for this comes from TOD policies regarding Village Green, and the municipality's previous suggestions related to green structure development at the railroad station.

Figure 44: Conceptual ideas of green structure in Önnestad, derived from theory, interviews and observations (modified from kristianstad.se, 2013, p. 123 (Bebyggelse (not to scale))).



4.7 Discussion

In the effort of seeking an answer to the thesis research question, 'what could Önnestad's green structure entail as part of a Transit-Oriented Development (TOD) in relation to social aspects?', the analysis firstly sought to get an insight of the spatial demarcations of Önnestad's existing green structure. Each of the elements studied was followed by a weighing of strength, weaknesses, together with requirements and future potentials, related to the existing green structure. The next step involved understanding what the perceived views attained means in relation to social aspect theory, by the assistance of Gehl (2010) and Lynch (1972).

The main findings are that there is a lack of green areas in the north, and when future densification measures are realised, the deficiency of green areas will increase. There are insufficient accessibility levels to the existing green areas of the town established by barriers in the landscape, connections are missing, and the outdoor activities available are few.

There is a need of more greenery in the north part of Önnestad. There is also a need of an urban park, and several green spaces of various sizes. Accessibility and a varied outdoor environment are demanded. Additionally, there is a requirement to ease the existing barriers in the landscape, for example the distance to the forest landscape in the south of Önnestad.

The results are part of a qualitative selection, not based on hard facts; it reflects the perceived views of the everyday environment. The result should, however, be recognised. The study could be extended, if an opportunity arises in the municipality. Field observations are also a recommended by Boverket (2007), in relation to the perceived access to areas. The method used was helpful in structuring the material derived from the primary study, as it gave directional input. The method affected the results, through the way it sectioned out different elements of the landscape.

Being influenced by Lynch's (1960) method, I did not experience it to control the study, to a point where it constricted my analysis. It assisted in sorting the data collected in an understandable way. However, the method in itself might be perceived as being a general sort. The study is constricted through being done at a conceptual scale, where the conceptual ideas are treated in a less detailed manner. The amount of people interviewed and my own experience, as an untrained observer has had a direct effect on the results obtained. Perhaps a skilled observer, would have detected or raised other issues, related to the everyday landscape.

The challenges concerning the conceptual ideas include, that there could be conflicts related to the arable land. Possible solutions to this could be to introduce urban farming, allotments, keep management cost at a low through having animal grazing at the large park area in the north, and motivate planners and farmers towards green infrastructure investments, by pointing to its benefits.

Another possible challenge for the ideas to be realised, are that the municipality's investments in green structure related to the future planned developments comes of short, and greenery is yet again treated as secondary. Potential solutions for this scenario, could for instance involve collaborations across municipal and regional boundaries, and/or private investments in green structure planning. Additional challenges could relate to municipal unwillingness to fund additional green areas, other than those proposed in the municipal plans. A possible answer could be to opt for green structure values and the benefits involved, as suggested by Brännlund (2013). One may argue, that it requires more than housing and workplaces to achieve a vibrant and lively urban area. It is as previously stated in the municipality's interest to invest in urban recreational grounds in the open arable land, in order to follow the clear standpoints.

While working with this thesis, I have visited Önnestad several times. The last time I visited the town was in November. At this time, no further progression could be detected regarding green structure development at the train station location. The thought behind my proposal of conceptual ideas is not to entirely dismantle the municipality of Kristianstad's plans for new green structure in relation to the proposed development in connection to the train station location. The idea was rather about finding alternative approaches of working with improving the green structure planning, based on existing precondition of the green structure in Önnestad.

Regarding densification in areas with sufficient public transport, guidelines are missing in Swedish planning of how this should be achieved, according to Schylberg (2008). This means that there are possibilities to influence the character of these surroundings in a planning phase. It could very much be worthwhile, looking at other models of planning, as for example Green TOD, that could increase the flexibility of land-use and increase the status of green structure in urban planning situations.

In relation to approaches towards Green TOD, the outlook is better for green structure, and there do exist proved examples of how green structure could be integrated, for example, as green infrastructure elements, reviewed in the Blake street project. However, a project such as Blake street, implies that green infrastructure is applied first, which is an alternate way of handling procedures in planning. Regardless of when, or if the densification proposals for Önnestad are realised, the north part of Önnestad still lacks adequate green spaces. Green areas in the north could host as great resources for the people in Önnestad for recreational purposes. Although it may seem infeasible to work with green structure at such scales in such a small town. The proposed green spaces might seem like a costly and unnecessary insertion. I believe the opposite to be true, because the municipality prognoses growth in Önnestad, and the fact that Önnestad is a basort in the municipality, along with the reintroduced train traffic, together with the attractiveness of living in a TOD community. These aspects could very well increase the demand of green areas in Önnestad. Önnestad could be a forerunner in its kind, and therefore succeed better in providing efficient green areas in comparison to its population amount. Early adaptation strategies alike Reston can be seen as precedent to this approach. The need for a future debate regarding the availability of green areas in the north of Önnestad, in relation to the municipality's growth prognoses, could be avoided if resources and requirements for the area are met.

Glossary

Brownfield Site refers to earlier developed and utilised premises or land, which are no longer in full use. These sites lay often deserted or vacant (Lehmann, 2010, p. 850).

Case Study is a method of analysing which is conducted in a real life context, suitable for complex situations, and can assist in expressing current ideas. It follows research methods of distinctive characters, in terms of analysis and the gathering of data (Ahern, 2002, p. 146).

Commons is often referred to as a 'common-pool resource' that a large quantity of people have the ability to make use of. Traditionally it could be a forest, the atmosphere, an ocean and its ecosystem, by means the resources which are publicly shared (Ostrom et al., 2002, p. 3).

Green Infrastructure assists in creating beneficial environmental services for its citizens by targeting both natural and man-made areas spatial forms. In larger scales such as a city or a county, green infrastructure is referred to the areas that supplies purer water and air, habitat creation and protection from floods. In a neighbourhood scale the concept is mentioned in regards to stormwater management and is on many occasions mentioned in relation to developments baring low impact on the environment (EPA, 2012).

Green Structure is a concept which refers to many aspects, such as structural, cultural, ecological and social (Magnér, 2013). It could also be explained as the interconnection between all green areas in urban and city areas, constituting a whole. This includes all nature areas, parks and gardens, and it is independent of ownership and management (boverket.se, 2012).

Green TOD is a concept which derived from a linkage between TOD and Green Urbanism (Cervero & Sullivan, 2010).

Infill Sites are unoccupied pieces of land that are encircled by already existing establishments (Calthorpe, 1993, p. 61).

LEED-ND is measurable bars which together recognise if a proposed or already existing development can be considered being environmental superior. The LEED-ND contains three divisions, which are taken into consideration: (1) Smart Location and Linkage (SLL); where to build, in regards to accessibility and location (2) Neighborhood Pattern and Design (NPD); what to build, by means the developments internal pattern and design, and (3) Green Infrastructure and Buildings (GIB); how to manage environmental impacts, its use of green technology and building techniques (Cumberland CID, 2010, p. 44).

Mixed-Use is a development structure that consists of commercial, housing, office and market space, which are grouped together in the same building, or lies at the same location in a different building (Lehmann, 2010, p. 859).

Natural Features are non-man-made natural attributes, such as lakes and plateaus. They can serve duplex functions, such as providing places for public right of way, and constitute places for protection of natural resources in TOD (Calthorpe, 1993, p. 72).

Networking Places can be explained as a policy that works to link urban areas, with the aim of creating urban networks. The requirement for these places is that they have regional importance. (Stojanovski, 2013).

New Growth Areas relates to undeveloped real estates of a larger scale that are located at the city's boundaries (Calthorpe, 1993, p. 61).

New Urbanism is a shift in urban design that originated in the 1980's in the United States. The movement encourages neighbourhoods that are mixed-use, oriented to transit, and is walkable in their structure. The aim is to further the progress of community and put an end to urban sprawl (Lehmann, 2010, p. 860).

Placemaking is an application regarding planning that is based on human scale and the perspective of the citizen. The aim is to achieve an identifiable neighbourhood that stands out and which encourages good quality of life and is livable in its kind (Stojanovki, 2013).

Redevelopable Sites refers to areas that are already constructed, that could be revived, which would in turn make way for increased uses along with available transit (Calthorpe, 1993, p. 61).

Secondary Areas lay approx 1, 6 kilometres away from a transit station or stop. They constitute less dense areas, with local streets that are immediately linked to a mixed-use TODs, which means easy access and a location near enough to walk or bike to. The areas interconnect neighbourhood parks, employment and schools in an accessible model (Calthorpe, 1993, p. 54).

Social Aspects concludes both individual and structural factors that affect a person's health and well-being. It contributes to the degree of wanting to stay in a specific place, and how much value the experience of functions adds, to the feeling of a vibrant urban environment or a coherent natural environment (bygg. stockholm.se, 2012 p. 60).

Transit-Oriented Development (TOD) is an American concept which defines a mixed-use communities, that lies within approximately 2,000-foot (600 metres) of walking intervals from train stations and centre areas (Calthorpe, 2013).

Urban Heat Island relates to places in larger city areas, which tend to attract heat much more than their surrounding areas. It constitutes a man-made character, such as a building, sidewalk or a street, which catches waste heat that is dispersed by the city's energy-use processes (Lehmann, 2010, p. 866).

Urban Sprawl addresses a residential growth pattern that consists of the dispersal of cities and suburbs in a low density. This method has led to a development where boundaries of cities are pressed outwards towards the urban edges (Lehmann, 2010, p. 866).

Walkability a term which points to the general terms for walking in an area. It grades the walking based on factors such as the pavement conditions, patterns of land use, quality of pedestrian uses, community support, and comfort and safety conditions. It can be assessed in regards to different scales. In a neighbourhood scale, it can be influenced by crossovers, sidewalks and the paved conditions, traffic speed and road width. Walkability is affected at the community level, by land use accessibility, such as target point's locations and the standards of the established connections. (vtpi.org, 2014).

Vehicle Kilometres Travelled (VKT) is a definition based on total traffic volumes (Cervero & Sullivan, 2010).

Village Greens are green attributes in TODs, which should be allocated at the points between the surrounding settlements, office spaces, and the central commercial locations. They should be of a size constituting to 1-3 acres. Their qualities should differ in relation to their size, intention, and also function (Calthorpe, 1993, p. 92).

Zoning or Land-Use Planning is an assessment relating to the possibilities of water and land areas. Alternatives are weighed to determine land-use in a specific area, in regards to its social and economic state. The process is conducted so that the best alternative can be adopted, which meets the requirements of the public and which addresses protection of resources (Ahern, 2002, p. 147).

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